MULTIPORT FUEL INJECTION (MFI)

FUEL INJECTION SYSTEM, SERVICING

Component locations, overview

The following list pertains to **Fig. 1** .

1. **Heated Oxygen Sensor (HO2S) -G39-, 50Nm**
   - Location: before Three Way Catalytic Converter (TWC)
2. **6-pin connector**
   - Black
   - Terminals gold plated
   - For Heated Oxygen Sensor (HO2S) before Three Way Catalytic Converter (TWC) -G39- and oxygen sensor heater -Z19-
   - Right on underside of vehicle
3. **Oxygen Sensor (O2S) after Three Way Catalytic Converter (TWC) - G130-, 50Nm**
   - Location: behind Three Way Catalytic Converter (TWC)
4. **4-pin connector**
   - Black
   - Terminals 3 and 4 gold-plated
   - For Oxygen Sensor (O2S) after Three Way Catalytic Converter (TWC) - G130- and oxygen sensor heating - Z29-
   - Right on underside of vehicle
5. **Camshaft position (CMP) sensor - G40-**
   - See **IGNITION SYSTEM COMPONENTS, REMOVING AND INSTALLING** , item 7
6. **Secondary Air Injection (AIR) Solenoid Valve -N112-**
   - Secondary air system:

   See **SECONDARY AIR INJECTION (AIR) SYSTEM**

7. **Recirculating valve for turbocharger -N249-**
   - Checking charge pressure system

   See **TURBOCHARGER, G-CHARGER**

8. **Ignition coils with power output stage (-N70-, -N127-, -N291-, -N292-)**

- See **IGNITION SYSTEM COMPONENTS, REMOVING AND INSTALLING** , item 2

9. **Wastegate Bypass Regulator Valve - N75-**
   - Checking charge pressure system

   See **TURBOCHARGER, G-CHARGER**

10. **Protective housing**
    - For Secondary Air Injection (AIR) Pump Relay -J299-
    - Secondary air system

    See **SECONDARY AIR INJECTION (AIR) SYSTEM**

11. **Motronic Engine Control Module (ECM) -J220-**

    (Motronic Motronic Engine Control Module (ECM) -J220- -J220-)

    - Location: below inner cover of plenum chamber, left side in driver compartment

12. **O-ring**
    - Replace if damaged
13. **Engine Coolant Temperature (ECT) sensor -G62-**
    - For Motronic Engine Control Module (ECM) -J220-
    - With Engine Coolant Temperature (ECT) gauge sensor -G2-
    - If necessary release pressure in cooling system before removing
    - Checking, see **ENGINE COOLANT TEMPERATURE (ECT) SENSOR -G62-, CHECKING**
14. **Retaining clip**
    - Check for secure seating
15. **Mass Air Flow (MAF) sensor -G70-**
16. **Valve 1 for camshaft adjustment - N205-**
    - Servicing valve train; checking camshaft adjustment

    See **ENGINE - CYLINDER HEAD, VALVETRAIN**

17. **Fuel pressure regulator**
18. **Injectors -N30- to -N33-**
19. **10 Nm**
20. **Engine Speed (RPM) Sensor -G28-**
    - Checking, see **ENGINE SPEED (RPM) SENSOR, CHECKING**
21. **O-ring**
    - Replace
22. **20 Nm**

- Tightening torque influences the function of the knock sensor

23. **Knock Sensor (KS) 2 -G66-**
    - Black
    - See **IGNITION SYSTEM COMPONENTS, REMOVING AND INSTALLING** , item 13
24. **2-pin connector**
    - Black
    - For Knock Sensor (KS) 2 -G66-
    - Identify before disconnecting
25. **Secondary Air Injection (AIR) pump motor -V101-**
    - Secondary air system

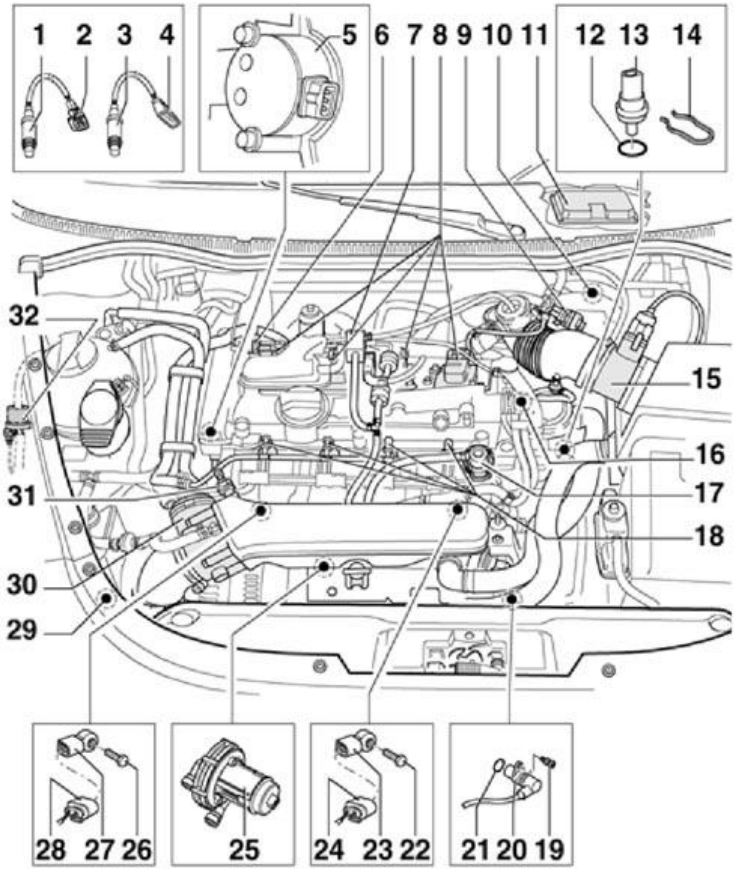
    See **SECONDARY AIR INJECTION (AIR) SYSTEM**

26. **20 Nm**
    - Tightening torque influences the function of the knock sensor
27. **Knock Sensor (KS) 1 -G61-**
    - Black
    - See **IGNITION SYSTEM COMPONENTS, REMOVING AND INSTALLING** , item 12
28. **2-pin connector**
    - Black
    - For knock sensor 1 -G61-
    - Identify before disconnecting
29. **Charge pressure sensor -G31-**
    - Checking charge pressure system

    See **TURBOCHARGER, G-CHARGER**

30. **Throttle Valve Control Module -J338-**
    - No cable disc for accelerator cable as this is an Electronic Power Control (EPC)
    - Checking, see **THROTTLE VALVE CONTROL MODULE -J338-, CHECKING**
    - If replaced, adapt Motronic Engine Control Module (ECM) -J220-, see **MOTRONIC ENGINE CONTROL MODULE (ECM) - J220- TO THROTTLE VALVE CONTROL MODULE -J338-, ADAPTING**
31. **Intake Air Temperature (IAT) sensor - G42-**
    - Checking, see **INTAKE AIR TEMPERATURE (IAT) SENSOR, CHECKING**
32. **Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80-**
    - Evaporative Emission (EVAP) system:

    See **EVAP CANISTER SYSTEM**



1 - Heated Oxygen Sensor (HO2S) -G39-, 50Nm
2 - 6-pin connector
3 - Oxygen Sensor (O2S) after Three Way Catalytic Converter (TWC) -G130-, 50Nm
4 - 4-pin connector
5 - Camshaft position (CMP) sensor -G40-
6 - Secondary Air Injection (AIR) Solenoid Valve -N112-
7 - Recirculating valve for turbocharger -N249-
8 - Ignition coils with power output stage (-N70-, -N127-, -N291-, -N292-)
9 - Wastegate Bypass Regulator Valve -N75-
10 - Protective housing
11 - Motronic Engine Control Module (ECM) -J220-
12 - O-ring
13 - Engine Coolant Temperature (ECT) sensor -G62-
14 - Retaining clip
15 - Mass Air Flow (MAF) sensor -G70-
16 - Valve 1 for camshaft adjustment -N205-
17 - Fuel pressure regulator
18 - Injectors -N30- to -N33-
19 - 10 Nm
20 - Engine Speed (RPM) Sensor -G28-
21 - O-ring
22 - 20 Nm
23 - Knock Sensor (KS) 2 -G66-
24 - 2-pin connector
25 - Secondary Air Injection (AIR) pump motor -V101-
26 - 20 Nm
27 - Knock Sensor (KS) 1 -G61-
28 - 2-pin connector
29 - Charge pressure sensor -G31-
30 - Throttle Valve Control Module -J338-
31 - Intake Air Temperature (IAT) sensor -G42-
32 - Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80-

Fig. 1: Identifying Fuel Injection System Components
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Fuel injection, general information

Servicing ignition system, see **IGNITION SYSTEM, SERVICING**

NOTE:

- **The Motronic Engine Control Module (ECM) - J220- is equipped with On Board Diagnostic (OBD). Before carrying out repairs and troubleshooting the DTC memory of all control modules must be checked using the automatic test sequence. This is necessary as various control modules are connected to each other via a data bus. The vacuum hoses and connections must also be checked (unmetered air).**
- **Fuel hoses in engine compartment must only be secured with spring type clips. The use of clamp or screw type clips is not permissible.**
- **Disconnecting and connecting the battery must only be done with the ignition switched off, otherwise the Motronic Engine Control Module (ECM) -J220- could be damaged.**
- **Components marked with * are checked via the On Board Diagnostic (OBD), see DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING .**
- **Components marked with **can be checked with the Output Diagnostic Test Mode (DTM), see OUTPUT DIAGNOSTIC TEST MODE (DTM) .**
- **For trouble -free operation of the electrical components, a voltage of at least 11.5 V is necessary.**
- **Do not use sealants containing silicone. Particles of silicone drawn into the engine, will not be burned in the engine and damage the oxygen sensor.**
- **Some checks can cause the control module to recognize and store a DTC. Therefore after completing all checks and repairs the DTC memory must be checked and if necessary erased, see DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING .**
- **Vehicles with an airbag are built with a crash/fuel shut -off. It reduces the risk of a vehicle burning in the event of a crash and that the fuel pump is switched off by the fuel pump relay. At the same time, this device improves the starting of the engine because as soon as the door is opened, the fuel pump is activated for 2 seconds to build up pressure in the fuel system.**

Safety precautions, see **SAFETY PRECAUTIONS**

Rules for cleanliness, see **RULES OF CLEANLINESS**

Technical data, see **TECHNICAL DATA**

Checking engine operating mode, see **ENGINE OPERATING MODE, CHECKING**

Fuel injection system components, removing and installing

The following list pertains to **Fig. 2** .

1. **10 Nm**
2. **Air cleaner**
   - Disassembling and assembling, see **AIR CLEANER, DISASSEMBLING AND ASSEMBLING**
3. **6 Nm**
4. **40-pin connector**
   - Only disconnect or connect with ignition switched off
   - Release to disconnect
5. **81-pin connector**
   - Only disconnect or connect with ignition switched off
   - Release to disconnect
6. **Motronic Engine Control Module (ECM) -J220-***

   (Motronic Motronic Engine Control Module (ECM) -J220- -J220-)

   - Component location, see **MULTIPORT FUEL INJECTION (MFI)** , engine compartment overview
   - Checking voltage supply, see **MOTRONIC ENGINE CONTROL MODULE (ECM)**
   - Procedure after voltage supply open circuit, see **PROCEDURE AFTER CORRECTING VOLTAGE SUPPLY OPEN CIRCUIT**
   - Replace, see **MOTRONIC ENGINE CONTROL MODULE (ECM) - J220-, REPLACING**
   - If replaced, carry out basic setting, see **MOTRONIC ENGINE CONTROL MODULE (ECM) - J220- TO THROTTLE VALVE CONTROL MODULE - J338-, ADAPTING**
7. **4-pin connector**
   - Component location, see **MULTIPORT FUEL INJECTION (MFI)** , engine compartment overview
   - Brown/Black
   - For oxygen sensor 2 after Three Way Catalytic Converter (TWC) -G130- and Heated Oxygen Sensor (HO2S) - Z29-
   - Terminals 3 and 4 gold plated
8. **Oxygen Sensor (O2S) 2 after Three Way Catalytic Converter (TWC) - G130-*, 50 Nm**
   - With 4-pin connector
   - Component location, see **MULTIPORT FUEL INJECTION (MFI)**
   - Grease only the threads with G 052 112 A3 hot bolt paste (anti-seize compound). Grease must not get into slots on sensor body
   - Remove and install with ring wrench 3337

- If replaced, erase learned values and adapt Motronic Engine Control Module (ECM) -J220- to Throttle Valve Control Module -J338-, see **MOTRONIC ENGINE CONTROL MODULE (ECM) - J220- TO THROTTLE VALVE CONTROL MODULE - J338-, ADAPTING**
- Sensor heating voltage supply via Fuel Pump (FP) Relay -J17-
- Checking Heated Oxygen Sensor (HO2S) for oxygen sensor after Three Way Catalytic Converter (TWC), see **HEATED OXYGEN SENSOR (HO2S) FOR OXYGEN SENSOR AFTER THREE WAY CATALYTIC CONVERTER (TWC), CHECKING**
- Checking Oxygen Sensor (O2S) and oxygen sensor control after Three Way Catalytic Converter (TWC), see **OXYGEN SENSOR AND OXYGEN SENSOR CONTROL AFTER THREE WAY CATALYTIC CONVERTER (TWC), CHECKING**

9. **6-pin connector**
   - Component location, see **MULTIPORT FUEL INJECTION (MFI)** , engine compartment overview
   - Black
   - For Oxygen Sensor (O2S) 1 before Three Way Catalytic Converter (TWC) -G39- and Heated Oxygen Sensor (HO2S) -Z19-
10. **Oxygen Sensor (O2S) 1 before Three Way Catalytic Converter (TWC) -G39- *, 50Nm**
    - With 6-pin connector
    - Component location, see **MULTIPORT FUEL INJECTION (MFI)**
    - Grease only the threads with G 052 112 A3 hot bolt paste (anti-seize compound). Grease must not get into slots on sensor body
    - Remove and install with ring wrench 3337
    - If replaced, erase learned values and adapt Motronic Engine Control Module (ECM) -J220- to Throttle Valve Control Module -J338-, see **MOTRONIC ENGINE CONTROL MODULE (ECM) - J220- TO THROTTLE VALVE CONTROL MODULE - J338-, ADAPTING**
    - Sensor heating voltage supply via Fuel Pump (FP) Relay -J17-
    - Checking Heated Oxygen Sensor (HO2S) before Three Way Catalytic Converter (TWC), see **FUEL INJECTION SYSTEM COMPONENTS, CHECKING**
    - Checking Oxygen Sensor (O2S) and oxygen sensor control before Three Way Catalytic Converter (TWC), see **OXYGEN SENSOR AND OXYGEN SENSOR CONTROL BEFORE THREE WAY CATALYTIC CONVERTER (TWC), CHECKING**
    - Checking Oxygen Sensor (O2S) aging, see **OXYGEN SENSOR AGING, OXYGEN SENSOR BEFORE THREE WAY CATALYTIC CONVERTER (TWC), CHECKING**
    - Terminals gold plated
11. **Bracket**
    - For Engine Speed (RPM) Sensor - G28-
12. **O-ring**
    - Replace
13. **Engine Speed (RPM) Sensor -G28-***
    - Component location, see **MULTIPORT FUEL INJECTION (MFI)** , engine compartment overview

- Checking, see **ENGINE SPEED (RPM) SENSOR, CHECKING**

14. **3-pin connector**
    - Gray
    - For Engine Speed (RPM) Sensor - G28-
15. **20 Nm**
16. **45 Nm**
17. **Support**
    - Between intake manifold and engine block
18. **Intake manifold**
19. **Charge pressure sensor -G31-***
    - Component location, see **MULTIPORT FUEL INJECTION (MFI)**
    - 4 pin connector
    - Removing and installing:

    See **TURBOCHARGER, G-CHARGER**

20. **Gasket**
    - Replace
21. **From Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80-**
    - Evaporative Emission (EVAP) system

    See **EVAP CANISTER SYSTEM**

22. **Throttle Valve Control Module -J338- ***
    - Checking, see **THROTTLE VALVE CONTROL MODULE -J338-, CHECKING**
    - 6-pin connector
    - No cable disc for accelerator cable as this is an Electronic Power Control (EPC)
    - Connector terminals gold-plated
    - If replaced adapt Motronic Engine Control Module (ECM) -J220-, see **MOTRONIC ENGINE CONTROL MODULE (ECM) - J220- TO THROTTLE VALVE CONTROL MODULE -J338-, ADAPTING**
    - If replaced adapt control module for automatic transmission:

    See **DIAGNOSIS - 01M**

23. **Return pipe**
    - Secure with spring-type clips
    - Check securely seated
    - To fuel delivery unit in fuel tank

See **FUEL SUPPLY**

24. **Supply pipe/hose**
    - Secure with spring-type clips
    - Make sure it is securely seated
    - From fuel filter:

    See **FUEL SUPPLY**

25. **Fuel rail with fuel injectors**
    - Disassembling and assembling, see **FUEL RAIL WITH FUEL INJECTORS, DISASSEMBLING AND ASSEMBLING**
26. **Intake Air Temperature (IAT) sensor - G42-***
    - Component location, see **MULTIPORT FUEL INJECTION (MFI)**
    - 2-pin connector
    - Checking, see **INTAKE AIR TEMPERATURE (IAT) SENSOR, CHECKING**
27. **Retaining clip**
    - Make sure it is securely seated
28. **Engine Coolant Temperature (ECT) sensor -G62-***
    - Component location, see **MULTIPORT FUEL INJECTION (MFI)** , engine compartment overview
    - For Motronic Engine Control Module (ECM) -J220-
    - With Engine Coolant Temperature (ECT) sensor -G2-
    - If necessary release pressure in cooling system before removing
    - Checking, see **ENGINE COOLANT TEMPERATURE (ECT) SENSOR -G62-, CHECKING**
    - Wiring chamber 3 and wiring chamber 4 for -G62-
    - Terminals 3 and 4 gold plated
29. **Connector**
    - Black, 4-pin
    - For Engine Coolant Temperature (ECT) sensor -G62-
    - Wiring chamber C and wiring chamber D for -G62-
    - Terminals C and D gold plated
30. **To pipe between turbo charger and charge air cooler**
31. **To pipe between turbo charger and charge air cooler**
32. **To intake hose at turbocharger**

    See **TURBOCHARGER, G-CHARGER**

33. **From crankcase breather**
    - Oil filter bracket

34. **From crankcase breather**
    - Valve cover
35. **From intake hose**
    - See item 7

    See **TURBOCHARGER, G-CHARGER**

36. **To Recirculating valve for turbocharger -N249-**
    - See item 7

    See **TURBOCHARGER, G-CHARGER**

37. **To pressure unit on turbo charger**

    See **TURBOCHARGER, G-CHARGER**

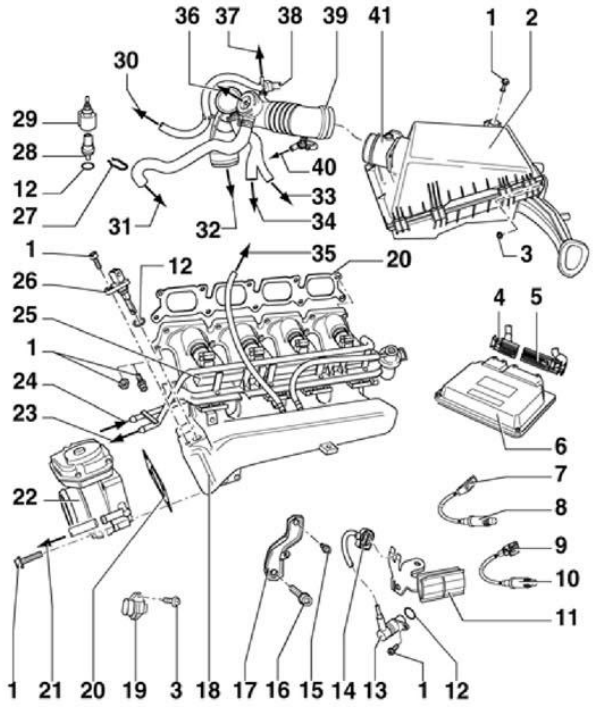
38. **Wastegate Bypass Regulator Valve - N75-*/****
    - Component location, see **MULTIPORT FUEL INJECTION (MFI)** , engine compartment overview
    - Charge pressure system:

    See **TURBOCHARGER, G-CHARGER**

39. **Intake hose**
    - Note installation position
40. **To vacuum booster**

    See **TURBOCHARGER, G-CHARGER**

41. **Mass Air Flow (MAF) sensor -G70-***
    - 5-pin connector
    - Socket 1 not occupied
    - Sensor and connector terminals are gold-plated
    - Checking, see **MASS AIR FLOW (MAF) SENSOR, CHECKING**



1 - 10 Nm
2 - Air cleaner
3 - 6 Nm
4 - 40-pin connector
5 - 81-pin connector
6 - Motronic Engine Control Module (ECM) -J220-*
7 - 4-pin connector
8 - Oxygen Sensor (O2S) 2 after Three Way Catalytic Converter (TWC) - G130-*, 50 Nm
9 - 6-pin connector
10 - Oxygen Sensor (O2S) 1 before Three Way Catalytic Converter (TWC) -G39-*, 50Nm
11 - Bracket
12 - O-ring
13 - Engine Speed (RPM) Sensor -G28-*
14 - 3-pin connector
15 - 20 Nm
16 - 45 Nm
17 - Support
18 - Intake manifold
19 - Charge pressure sensor -G31-*
20 - Gasket
21 - From Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80-
22 - Throttle Valve Control Module -J338-
23 - Return pipe
24 - Supply pipe/hose
25 - Fuel rail with fuel injectors
26 - Intake Air Temperature (IAT) sensor - G42-*
27 - Retaining clip
28 - Engine Coolant Temperature (ECT) sensor -G62-*
29 - Connector
30 - To pipe between turbo charger and charge air cooler
31 - To pipe between turbo charger and charge air cooler
32 - To intake hose at turbocharger
33 - From crankcase breather
34 - From crankcase breather
35 - From intake hose
36 - To Recirculating valve for turbocharger -N249-
37 - To pressure unit on turbo charger
38 - Wastegate Bypass Regulator Valve - N75-*/**
39 - Intake hose
40 - To vacuum booster
41 - Mass Air Flow (MAF) sensor -G70-*

G03449977

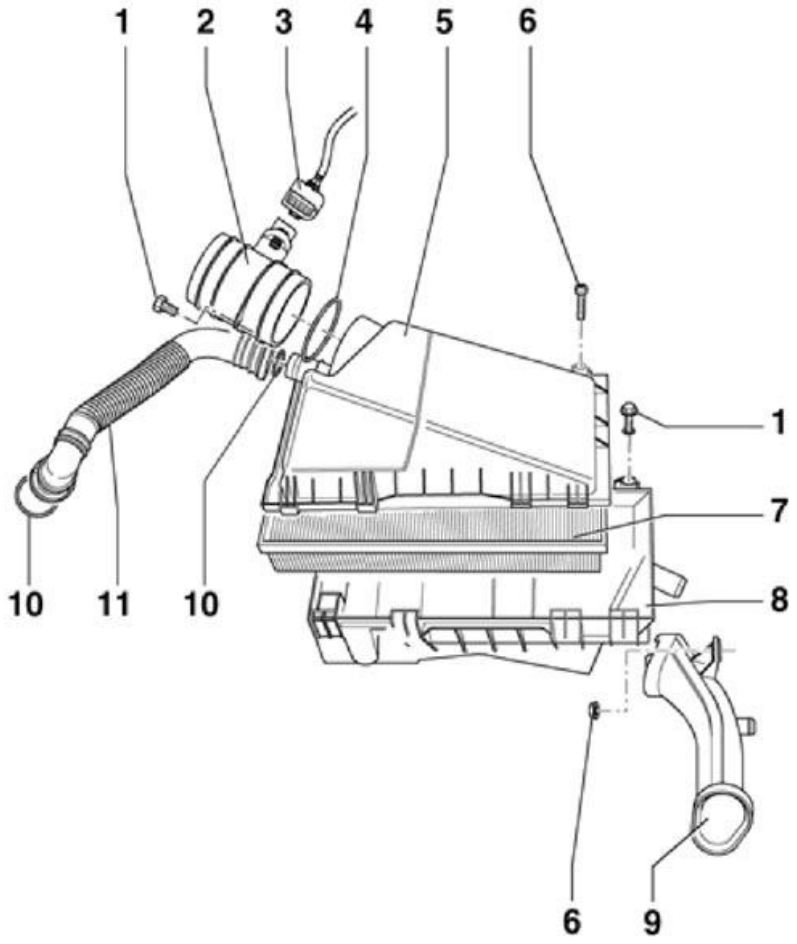
Fig. 2: Exploded View Of Fuel Injection System Components
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Air cleaner, disassembling and assembling

The following list pertains to **Fig. 3** .

1. **10 Nm**
2. **Mass Air Flow (MAF) sensor -G70-**
   - Sensor and connector terminals are gold-plated
   - Socket 1 not occupied
   - Checking, see **MASS AIR FLOW (MAF) SENSOR, CHECKING**
3. **Connector**
   - Black, 5-pin
   - Sensor and connector terminals are gold-plated
   - Socket 1 not occupied
4. **Seal**
   - Replace if damaged
5. **Air cleaner upper part**
6. **6 Nm**
7. **Filter element**
8. **Air cleaner lower part**
9. **Air duct**
10. **O-ring**
    - Replace if damaged
11. **Intake hose**
    - Ensure seated tightly
    - Press together at front to release
    - To Secondary air injection (AIR) pump motor -V101-:

    See **EXHAUST SYSTEM, EMISSION CONTROLS**



1 - 10 Nm
2 - Mass Air Flow (MAF) sensor -G70-
3 - Connector
4 - Seal
5 - Air cleaner upper part
6 - 6 Nm
7 - Filter element
8 - Air cleaner lower part
9 - Air duct
10 - O-ring
11 - Intake hose
G03449978

Fig. 3: Identifying MAF Sensor And Air Cleaner Components
Courtesy of VOLKSWAGEN OF AMERICA, INC.

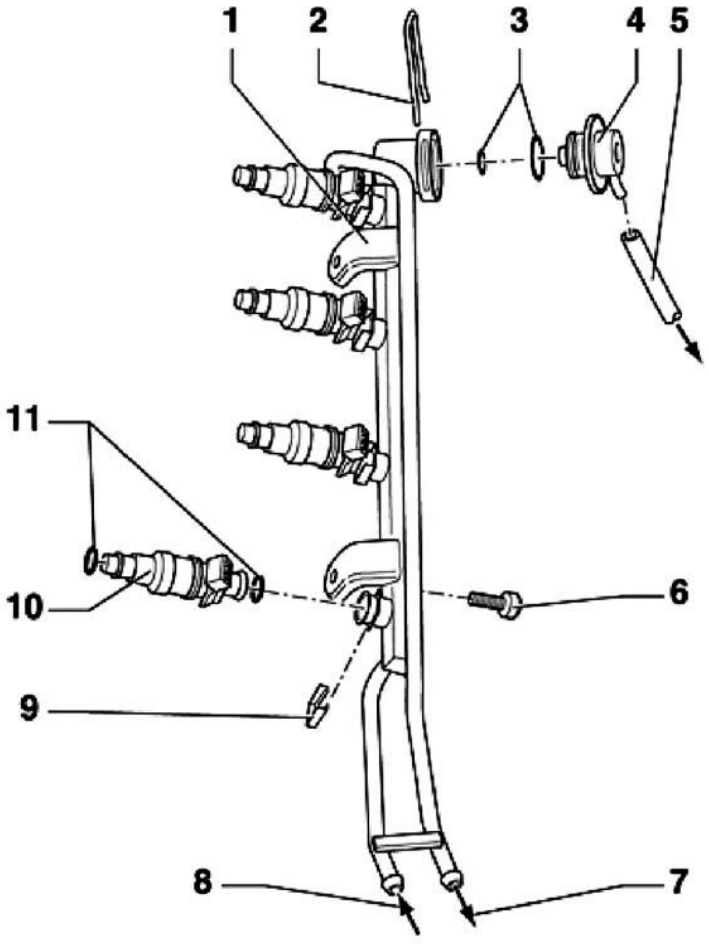
Fuel rail with fuel injectors, disassembling and assembling

The following list pertains to **Fig. 4** .

1. **Fuel rail**
2. **Retaining clip**
   - Check securely seated
3. **O-ring**
   - Replace if damaged
   - Before installing moisten with clean engine oil
4. **Fuel pressure regulator**
   - Checking, see **FUEL PRESSURE REGULATOR AND HOLDING PRESSURE, CHECKING**
5. **Vacuum hose**

   To intake manifold

6. **10 Nm**
7. **Return flow connection**
8. **Supply connection**
9. **Retaining clip**
   - Ensure seated correctly at injector and fuel rail
10. **Fuel injectors (-N30- to -N33-)***
    - Checking, see **FUEL INJECTORS, CHECKING**
    - 2-pin connector
    - Resistance 12 to 17
11. **O-ring**
    - Replace
    - Before installing moisten with clean engine oil



1 - Fuel rail
2 - Retaining clip
3 - O-ring
4 - Fuel pressure regulator
5 - Vacuum hose
6 - 10 Nm
7 - Return flow connection
8 - Supply connection
9 - Retaining clip
10 - Fuel injectors (-N30- to -N33-)*
11 - O-ring

G03449979

Fig. 4: Disassembling Fuel Rail With Injectors
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Safety precautions

WARNING: Fuel system is under pressure! Before opening the system place a cloth around the connection. Then release pressure by carefully loosening the connection.

To prevent injuries to persons and/or damage to the fuel injection and ignition system, the following must be noted:

- For safety reasons the fuse No. 28 must be removed from the fuse holder before opening the fuel system, otherwise the fuel pump can be activated by the door terminal switch.
- Do not touch or disconnect ignition wiring when the engine is running or being turned at starter speed.
- The ignition must be switched off before connecting or disconnecting injection or ignition system wiring or tester cables.

Observe following if test and measuring instruments are required during a test drive:

- Test and measuring instruments must be secured to rear seat and operated by a 2nd person from this location.
- If test and measuring instruments are operated from front passenger's seat and the vehicle is involved in an accident, there is a possibility that the person sitting in this seat may receive serious injuries when the airbag is triggered.

If the engine is to be turned at starter speed, without starting:

- Disconnect all 4 -pin connectors -2- from power output stage for ignition coils -1-.

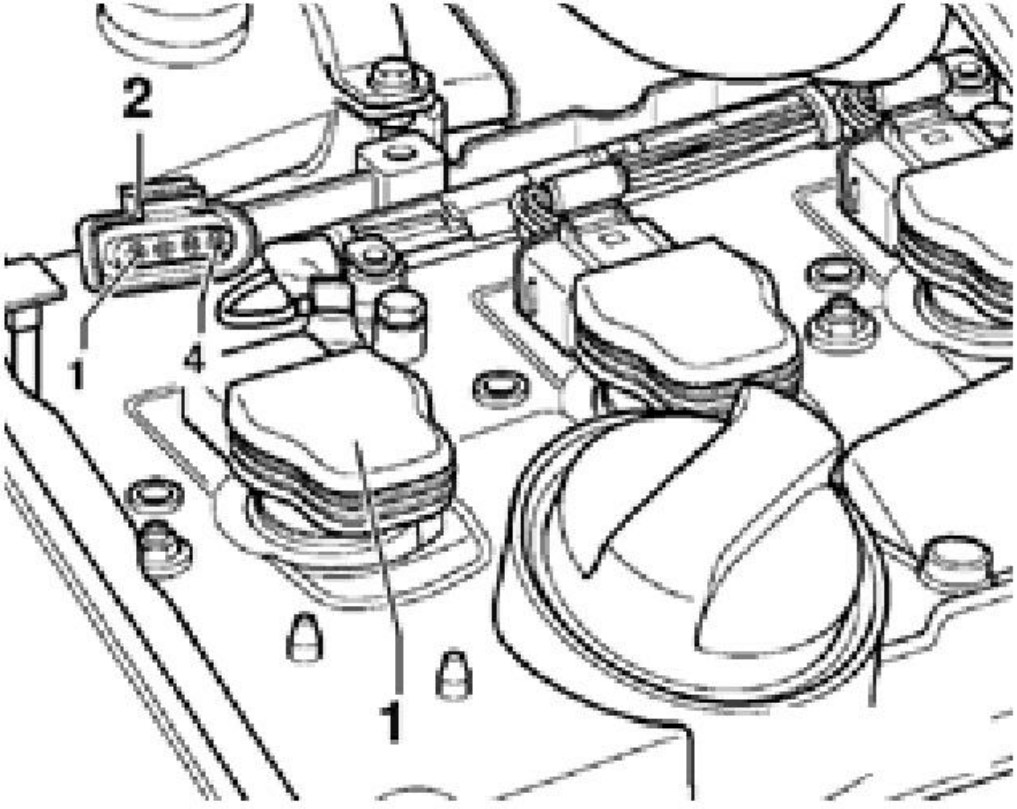


Fig. 5: Disconnecting All Pin Connectors From Power Output Stage For Ignition Coils
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Pull fuse No. 32 out of fuse holder.

NOTE: Removing fuse 32 interrupts the voltage supply to the fuel injectors. Fuse holder is located behind access panel at far left end of dash.

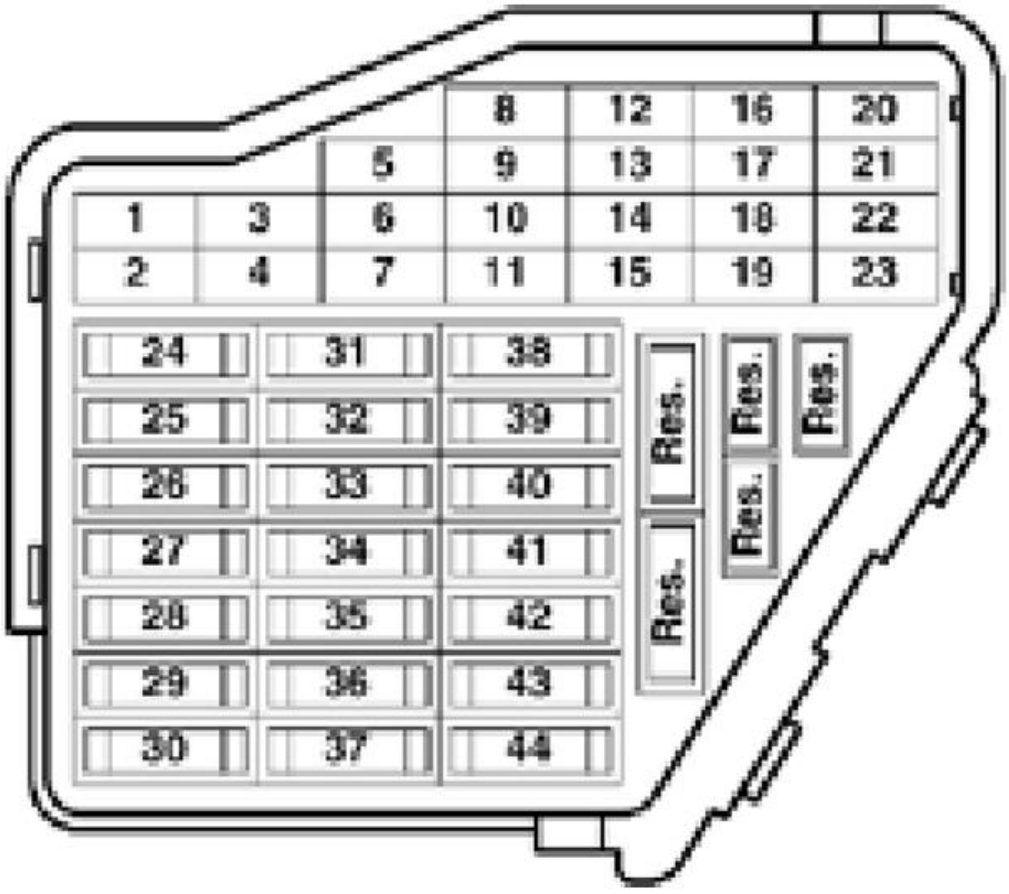


Fig. 6: Removing Fuse 32 Interrupts Voltage Supply To Fuel Injectors
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Rules of cleanliness

When working on the fuel supply/injection system, pay careful attention to the following 5 rules:

- Thoroughly clean all unions and the adjacent areas before disconnecting.
- Place parts that have been removed on a clean surface and cover. Do not use fluffy cloths!
- Carefully cover opened components or seal, if the repair cannot be carried out immediately.
- Only install clean components: Only unpack replacement parts immediately prior to installation. Do not use parts that have been stored loose (e.g. in tool boxes etc.).

- When the system is open: Do not work with compressed air if this can be avoided. Do not move vehicle unless absolutely necessary.

Technical data

TECHNICAL DATA SPECIFICATION

Engine code	AWP	AWV
Idle check (at normal operating temperature)		
Idle speed(1) RPM		
Manual transmission	760 to 810 (1)	760 to 810(1)
Automatic transmission	700 to 750 (1)	700 to 750(1)
Motronic Engine Control Module (ECM) -J220-(2)		
System	Motronic ME7.5	Motronic ME7.5
Part number(3)		
Manual transmission	1C0 906 032	06A 906 032 GA
Automatic transmission		06A 906 032 GB
Governed speed RPM	from approx. 6800	from approx. 6800

(1) Not adjustable

(2) Replacing Motronic Engine Control Module (ECM) -J220-, see **MOTRONIC ENGINE CONTROL MODULE (ECM)**

(3) For latest part number for Engine Control Module: See Parts catalog.

FUEL INJECTION SYSTEM COMPONENTS, CHECKING

Heated Oxygen Sensor (HO2S) for oxygen sensor before Three Way Catalytic Converter (TWC), checking

NOTE:

- **Raise vehicle to reach oxygen sensor connector**
- **Only gold-plated terminals must be used to repair the terminals in the oxygen sensors connectors.**

Special tools, test equipment and auxiliary items

- VAG 1551 scan tool or VAG 1552 mobile scan tool with VAG 1551/3B cable
- VAG 1598/31 test box
- VAG 1526 A or Fluke 83 multimeter
- VAG 1594 adapter set
- Electrical Wiring Diagram

Test conditions

- All fuses must be OK. Fuse holder is located behind access panel at far left end of dash.
- The battery voltage must be at least 11.5 V
- Fuel pump relay must be OK

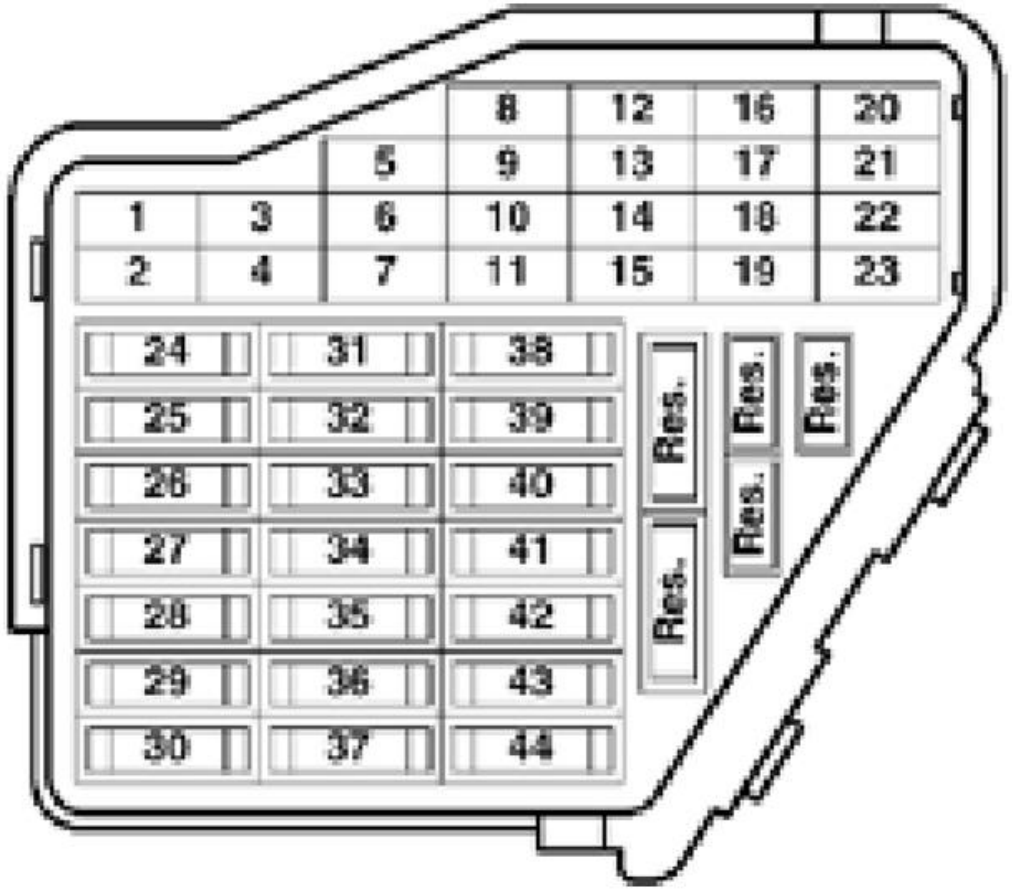


Fig. 7: Locating Fuses
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Test sequence

- Connect VAG 1551 scan tool ((VAG 1552). Start engine and select "Address word" 01 of Motronic Engine Control Module (ECM) -J220-. Engine must be running at idle speed. Connecting scan tool and selecting Motronic Engine Control Module (ECM) - J220-, see **VAG 1551, CONNECTING AND SELECTING MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-** .

Indicated on display

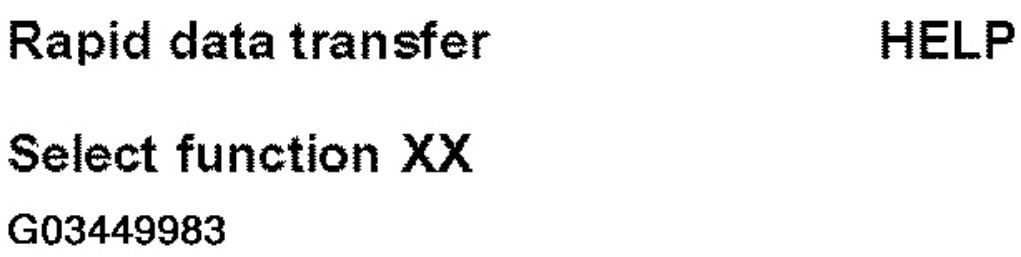


Fig. 8: Identifying Scan Tool Display (1 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0- and -8- for function "Read measuring value block" and confirm entry with -Q- button.

  Indicated on display

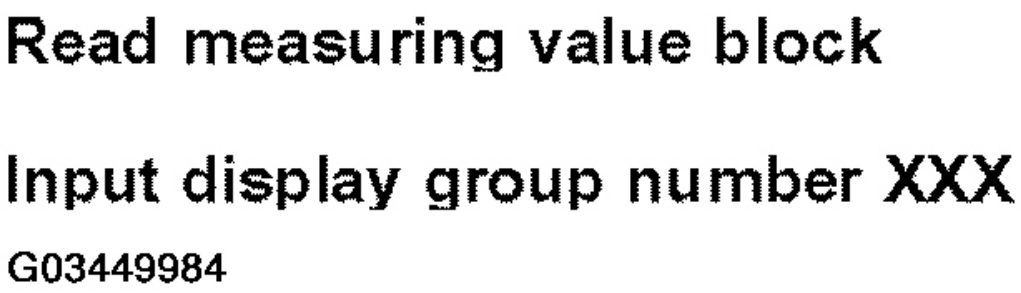


Fig. 9: Identifying Scan Tool Display (2 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0-, -4- and -1- for "Display group number 41" and confirm entry with -Q- button.

  Indicated on display (1 to 4 Display zones)

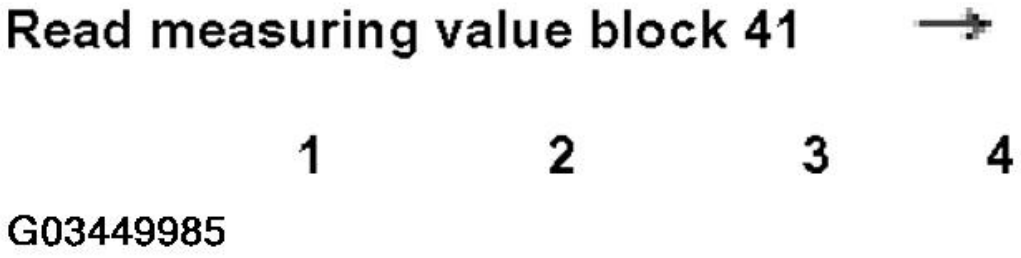


Fig. 10: Identifying Scan Tool Display (3 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Run engine for 2 minutes at idling speed.
- Check status of Heated Oxygen Sensor (HO2S) before catalytic converter in display field 2: Display: Htg.bC.ON, Htg.bC.OFF (alternating)

DISPLAY GROUP 41: HEATED OXYGEN SENSOR (HO2S) BEFORE AND AFTER THREE WAY CATALYTIC CONVERTER (TWC)

	Display zones			
	1	**2**	**3**	**4**
Display group 41: Heated Oxygen Sensor (HO2S) before and after Three Way Catalytic Converter (TWC)				
Display	-	Htg.bC.ON / Htg.bC.OFF	-	Htg.aC.ON / Htg.aC.OFF
Indicated	-	Heated Oxygen Sensor (HO2S) before Three Way Catalytic Converter (TWC) ON or Heated Oxygen Sensor (HO2S) before Three Way Catalytic Converter (TWC) OFF	Heated Oxygen Sensor (HO2S) after Three Way Catalytic Converter (TWC) ON or Heated Oxygen Sensor (HO2S) after Three Way Catalytic Converter (TWC) OFF	
Working range	-	-	-	-
Specification	-	Htg.bC.ON Htg.bC.OFF (occasionally alternating)	-	-
	-	If the specification is not achieved, see **CONTINUATION**	-	-

NOTE: **The Heated Oxygen Sensor (HO2S) may be switched ON or OFF depending on the operating conditions of the engine, therefore the display in display zone 2 may show "Htg.bC.ON" or alternating from "Htg.bC.ON" to "Htg.bC.OFF."**

If the specification is obtained:

- Press button.
- Press buttons -0- and -6- for function "End output" and confirm entry with -Q- button.
- Switch off ignition.

Continuation

If the specifications are not obtained:

- Press --> button.
- Press buttons -0- and -6- for function "End output" and confirm entry with -Q- button.
- Switch off ignition.
- Remove protective cover -arrows- and separate 6-pin connector (black) -1- to Heated Oxygen Sensor (HO2S) before Three Way Catalytic Converter (TWC) -G39-.

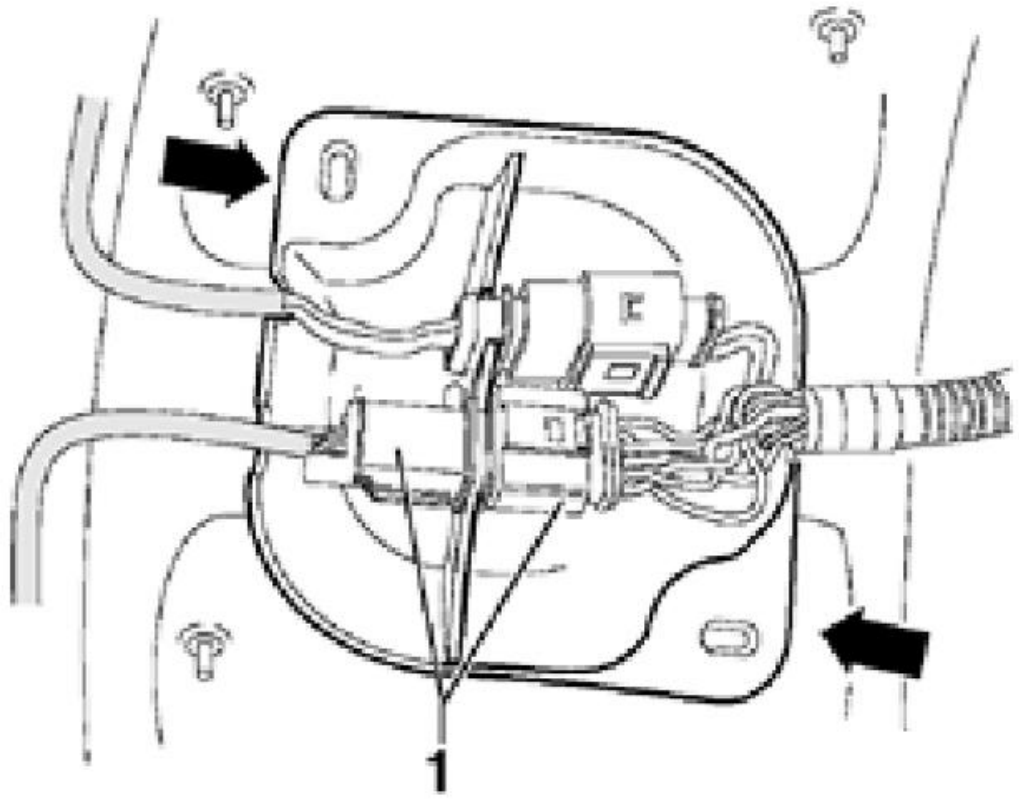


Fig. 11: Separating 6-Pin Connector (Black) -1- To HO2S -G39- Before TWC
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Set multimeter to measure resistance and connect it to terminals 3 + 4 of connector to oxygen sensor. Check oxygen sensor heating for closed circuit.

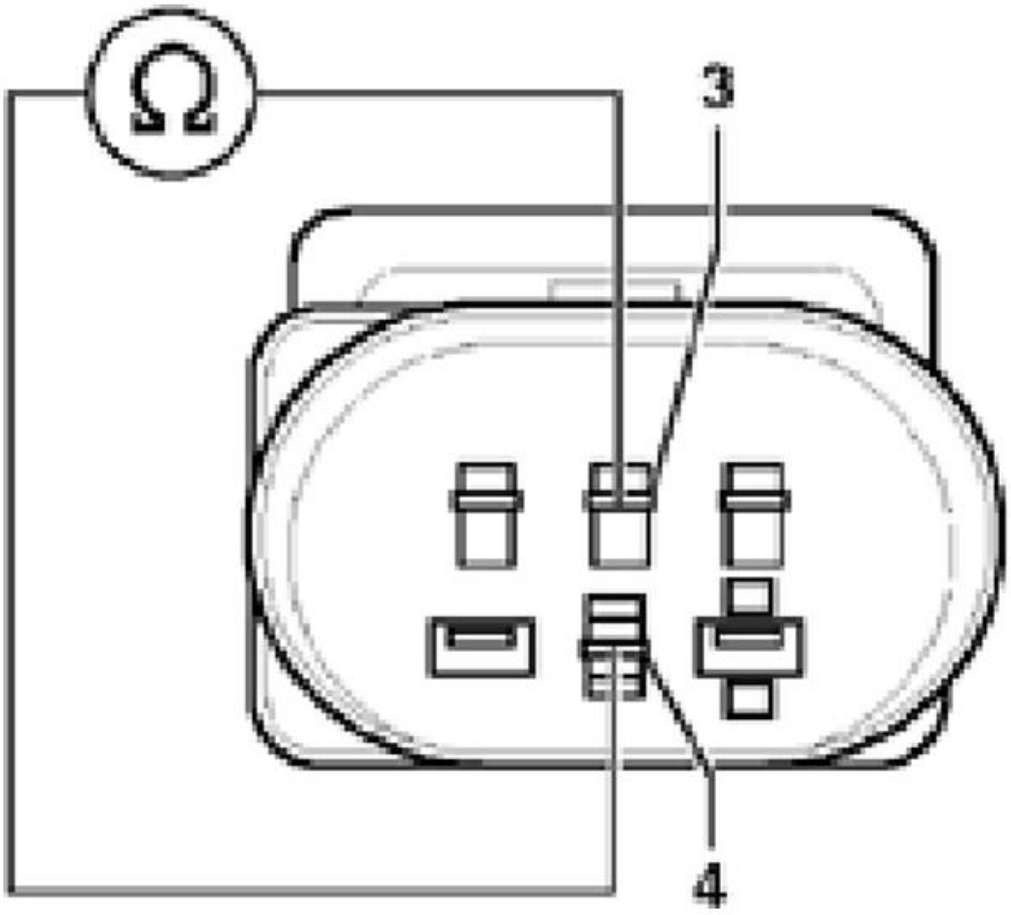


Fig. 12: Measuring Resistance Between Terminals 3 And 4 Of HO2S -G39- Before TWC Connector
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Specification: 2.5...10 (at room temperature)

If it is determined that oxygen sensor heating has an open circuit:

- Replace Heated Oxygen Sensor (HO2S) -G39-.
- Check DTC Memory, if necessary, repair any malfunctions and then Erase DTC Memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING** .
- Read readiness code, see **READINESS CODE, DISPLAYING** . If DTC memory has been erased or

Motronic Engine Control Module (ECM) -J220- was disconnected from battery positive, readiness code must be generated again, see **READINESS CODE, GENERATING** .

If oxygen sensor heating has continuity:

Checking voltage supply

- Set multimeter to measure voltage and connect to terminal 3 (connector to Motronic Engine Control Module (ECM) -J220-) and Ground (GND).

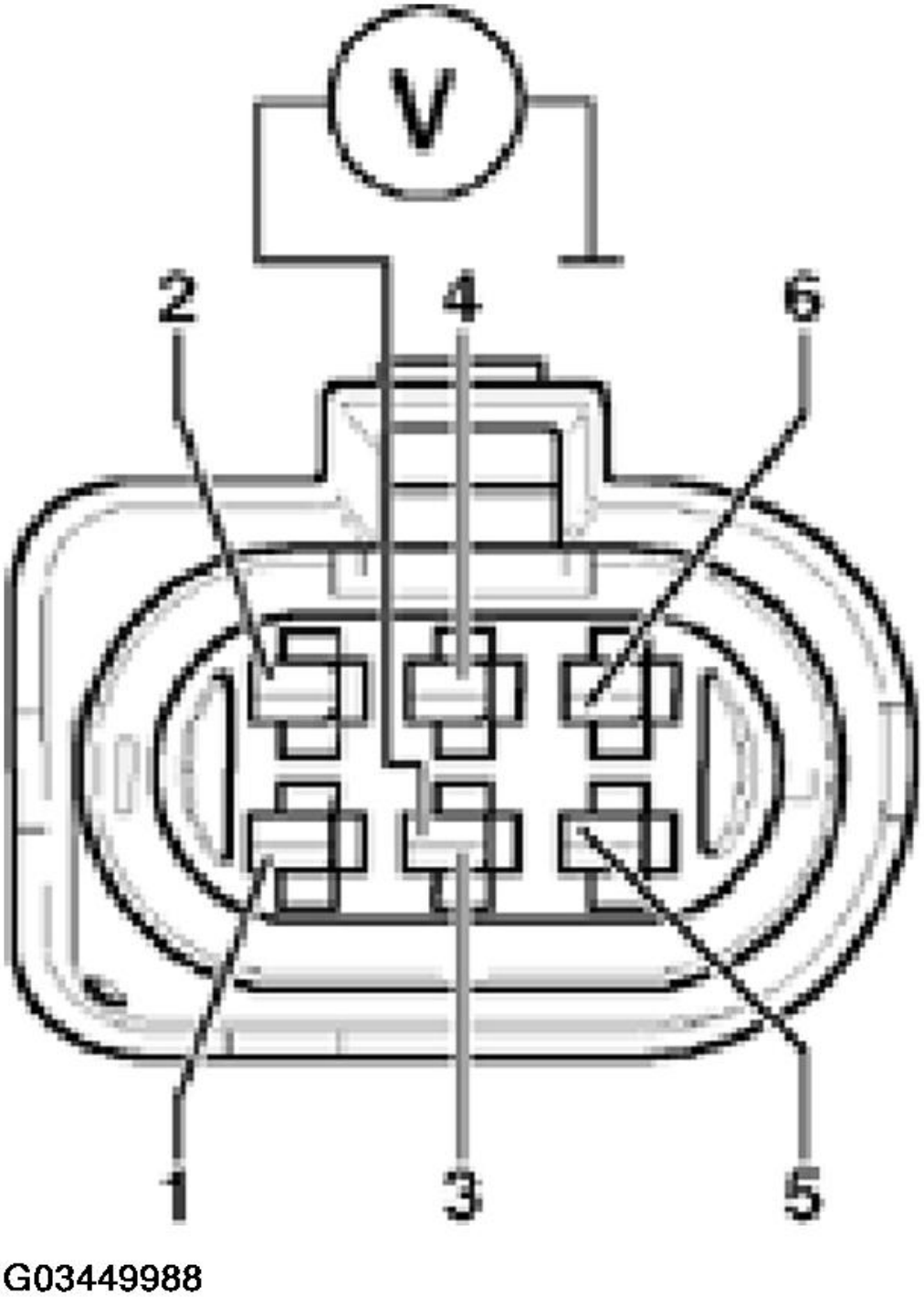


Fig. 13: Measuring Voltage Between Terminal 3 And Ground On HO2S -G39- Harness Connector

Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Start engine and run at idling speed.
- Measure voltage supply:

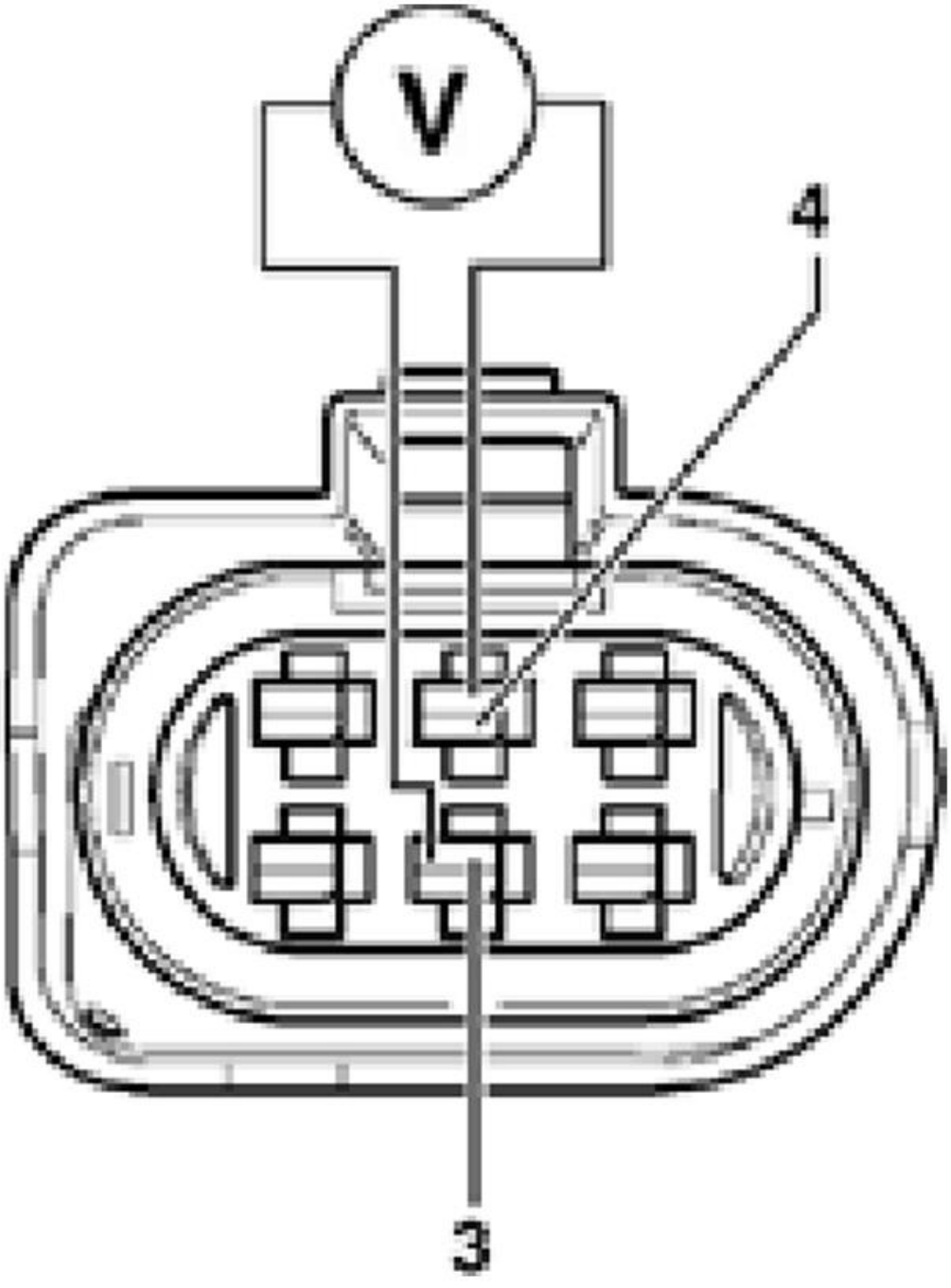
  Specification: 11.0 to 14.5 V

  If the specification is not obtained:

- Check wiring from terminal 3 to Fuel Pump (FP) Relay -J17- using Electrical Wiring Diagram.

  If the specification is obtained:

- Connect multimeter using aux. cables from VAG 1594 to measure voltage at terminals 3 and 4 (connector to Motronic Engine Control Module (ECM) -J220-).



G03449989

Fig. 14: Measuring Voltage Between Terminal 3 And 4 On HO2S -G39- Harness Connector
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Measure voltage supply and note display group 41, display zone 2.

  Display: Htg.bC.ON:

  - Specification: 11.0 to 14.5 V

  Display: Htg. bC.ON/Htg.bC.OFF (alternating):

  - Specification: Between 0.0 to 12.0 V fluctuating
- Switch off ignition.

  If no voltage is present:

- Remove inner plenum chamber cover, left:

See **PLENUM CHAMBER INNER COVER, REMOVING AND INSTALLING**

- Connect VAG 1598/31 test box to control module wiring harness. Motronic Engine Control Module (ECM) -J220- is not connected by this action.

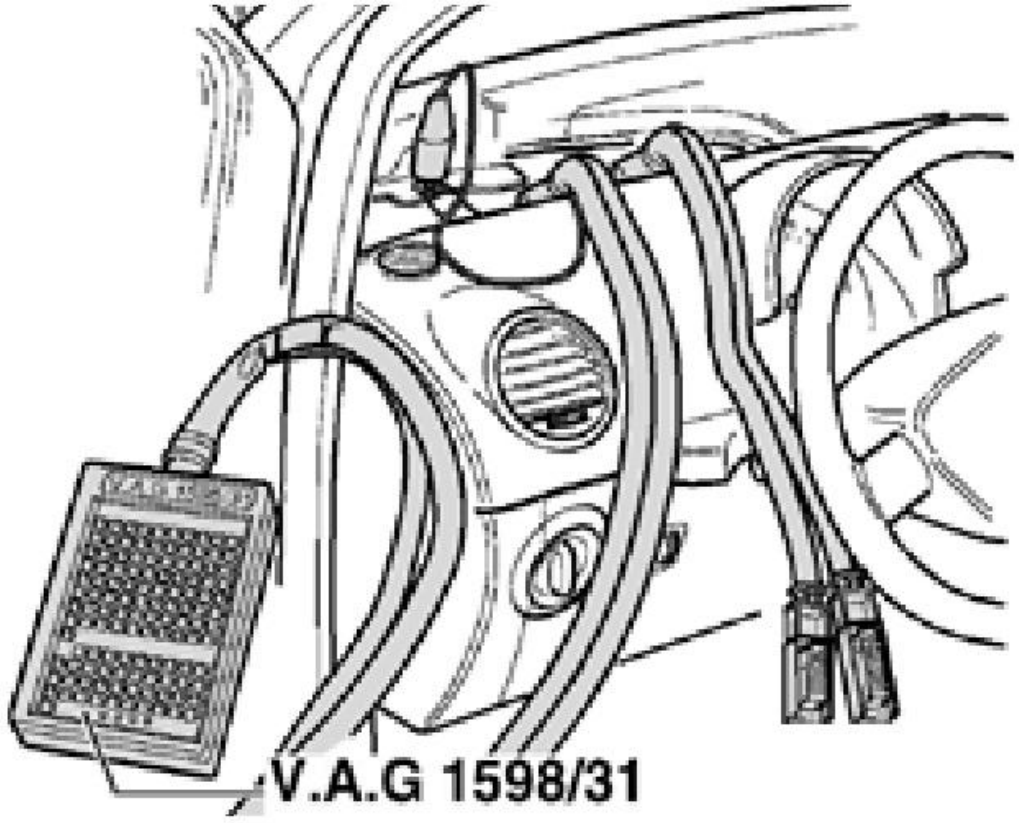


Fig. 15: Connecting VAG 1598/31 Test Box To Control Module Wiring Harness
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check wiring for open circuit between test box and 6 -pin connector according to Electrical Wiring Diagrams.

  terminal 4 + socket 5

  Wire resistance: Max. 1.5

  If no wiring malfunction is found:

- Replace Motronic Engine Control Module (ECM) -J220-, see **MOTRONIC ENGINE CONTROL MODULE (ECM) - J220-, REPLACING** .

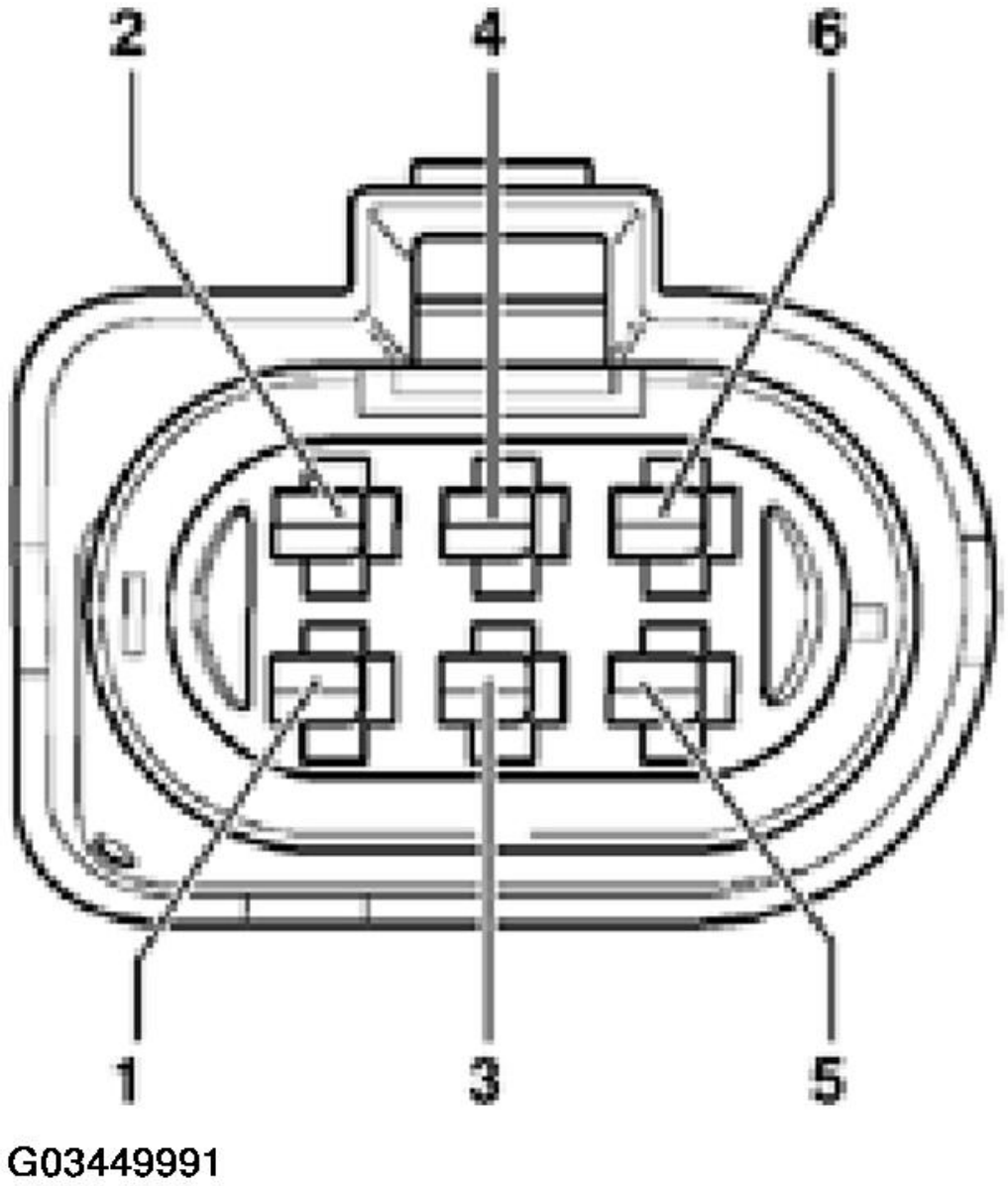


Fig. 16: Identifying HO2S -G39- Harness Connector Terminals
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Heated Oxygen Sensor (HO2S) for oxygen sensor after Three Way Catalytic Converter (TWC), checking

Special tools, test equipment and auxiliary items

- VAG 1551 scan tool or VAG 1552 mobile scan tool with VAG 1551/3B cable
- VAG 1598/31 test box
- VAG 1526 A or Fluke 83 multimeter
- VAG 1594 adapter set
- Electrical Wiring Diagrams

Test conditions

- All fuses must be OK. Fuse holder is located behind access panel at far left end of dash
- Battery voltage must be at least 11.5 V
- Fuel pump relay must be OK

G03449992

Fig. 17: Locating Fuses
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Test sequence

- Connect VAG 1551 scan tool (or VAG 1552). Start engine and select "Address word" 01 of Motronic Engine Control Module (ECM) -J220-. Engine must be running at idle speed. Connecting scan tool and selecting Motronic Engine Control Module (ECM) -J220-, see **VAG 1551, CONNECTING AND SELECTING MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-** .

Indicated on display

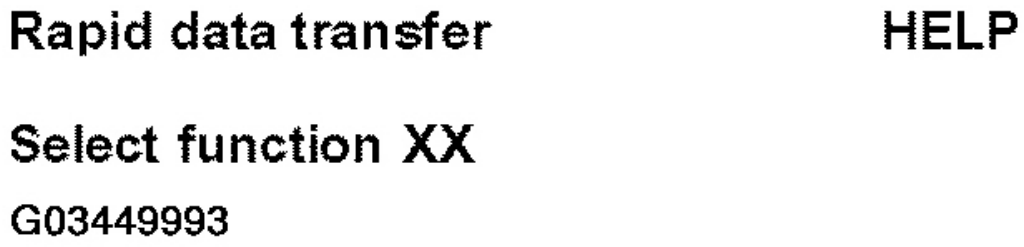


Fig. 18: Identifying Scan Tool Display - Checking HO2S After TWC (1 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0- and -8- for function "Read measuring value block" and confirm entry with -Q- button.

  Indicated on display

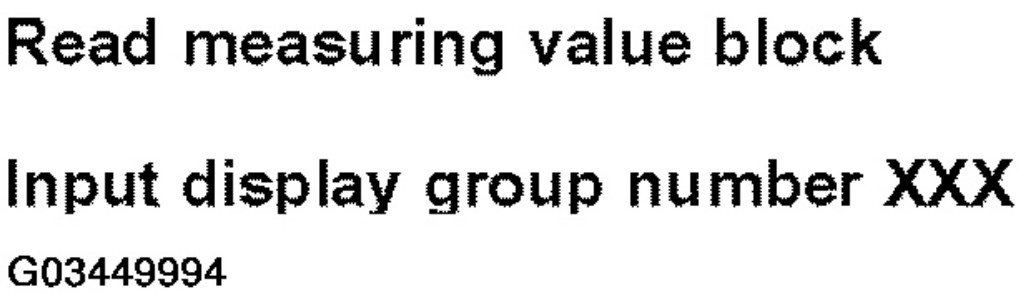


Fig. 19: Identifying Scan Tool Display - Checking HO2S After TWC (2 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0-, -4- and -1- for "Display group number 41" and confirm entry with -Q- button.

  Indicated on display (1 to 4 Display zones)

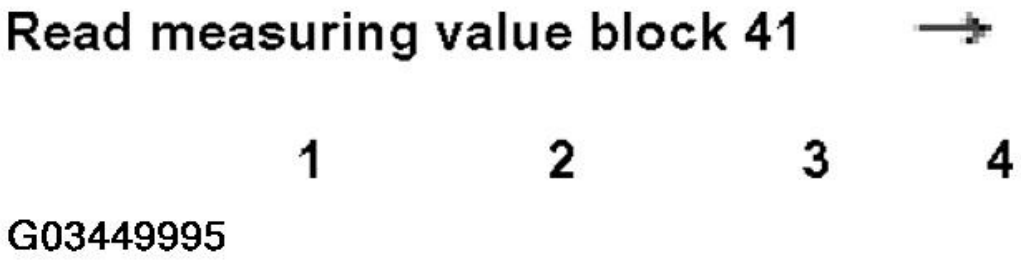


Fig. 20: Identifying Scan Tool Display - Checking HO2S After TWC (3 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check status of Heated Oxygen Sensor (HO2S) behind Three Way Catalytic Converter (TWC) in display field 4: Display: Htg.aC.ON, Htg.aC.OFF (alternating)

DISPLAY GROUP 41: HEATED OXYGEN SENSOR (HO2S) BEFORE AND AFTER THREE WAY CATALYTIC CONVERTER (TWC)

	Display zones			
	1	**2**	**3**	**4**
Display group 41: Heated Oxygen Sensor (HO2S) before and after Three Way Catalytic Converter (TWC)				
Display	-	Htg.bC.ON / Htg.bC.OFF	-	Htg.aC.ON / Htg.aC.OFF
Indicated	-	Heated Oxygen Sensor (HO2S) before Three Way Catalytic Converter (TWC) ON or Heated Oxygen Sensor (HO2S) before Three Way Catalytic Converter (TWC) OFF	-	Heated Oxygen Sensor (HO2S) after Three Way Catalytic Converter (TWC) ON or Heated Oxygen Sensor (HO2S) after Three Way Catalytic Converter (TWC) OFF
Working range	-	-	-	-
Specification	-	-	-	Htg.aC.ON Htg.aC.OFF (occasionally alternating)

	-	-	-	If the specification is not achieved, see **CHECKING VOLTAGE SUPPLY** , Continuation

NOTE: The Heated Oxygen Sensor (HO2S) may be switched ON or OFF depending on the operating conditions of the engine, therefore the display in display zone 4 may show "Htg.aC.ON" or alternating from "Htg.aC.ON" to "Htg.aC.OFF."

If the specification is obtained:

- Press --> button.
- Press buttons -0- and -6- for function "End output" and confirm entry with -Q- button.
- Switch off ignition.

Continuation

If the specifications are not obtained:

- Press --> button.
- Press buttons -0- and -6- for function "End output" and confirm entry with -Q- button.
- Switch off ignition.
- Remove protective cover -arrows- and separate 4-pin connector (brown/black) -1- to Oxygen sensor after Three Way Catalytic Converter (TWC) -G130-.

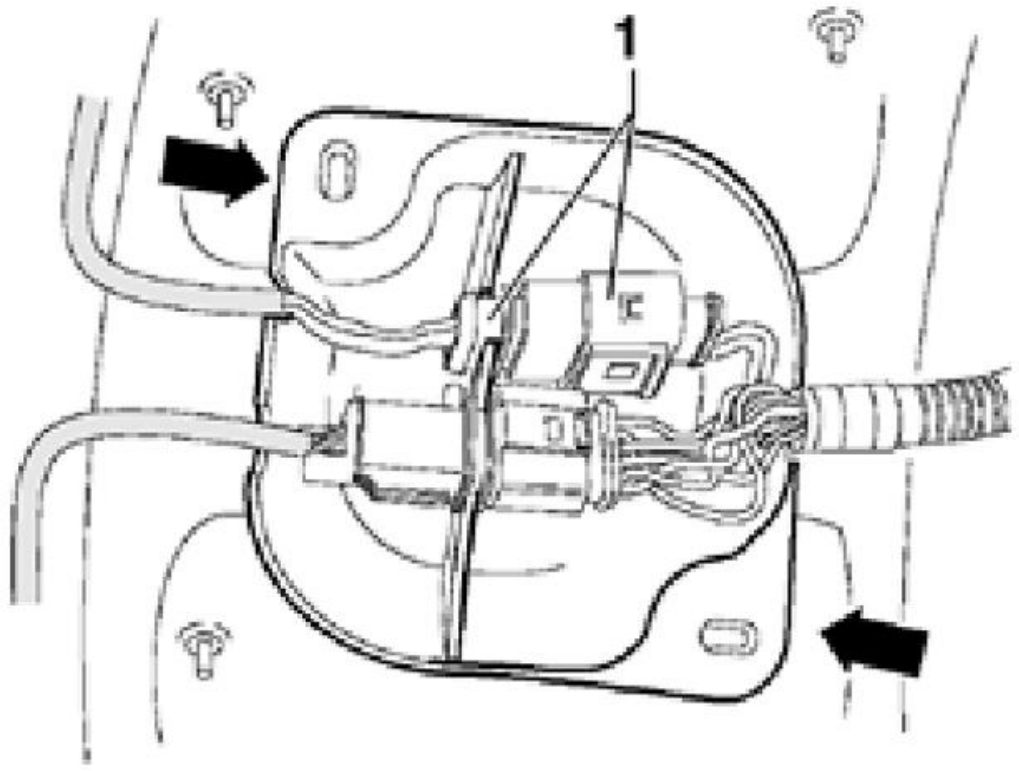


Fig. 21: Separating 4-Pin Connector (Brown/Black) -1- For HO2S -G130- After TWC
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Set multimeter to check resistance and connect it to terminals 1 + 2 of Oxygen Sensor connector. Check Oxygen Sensor heating for continuity

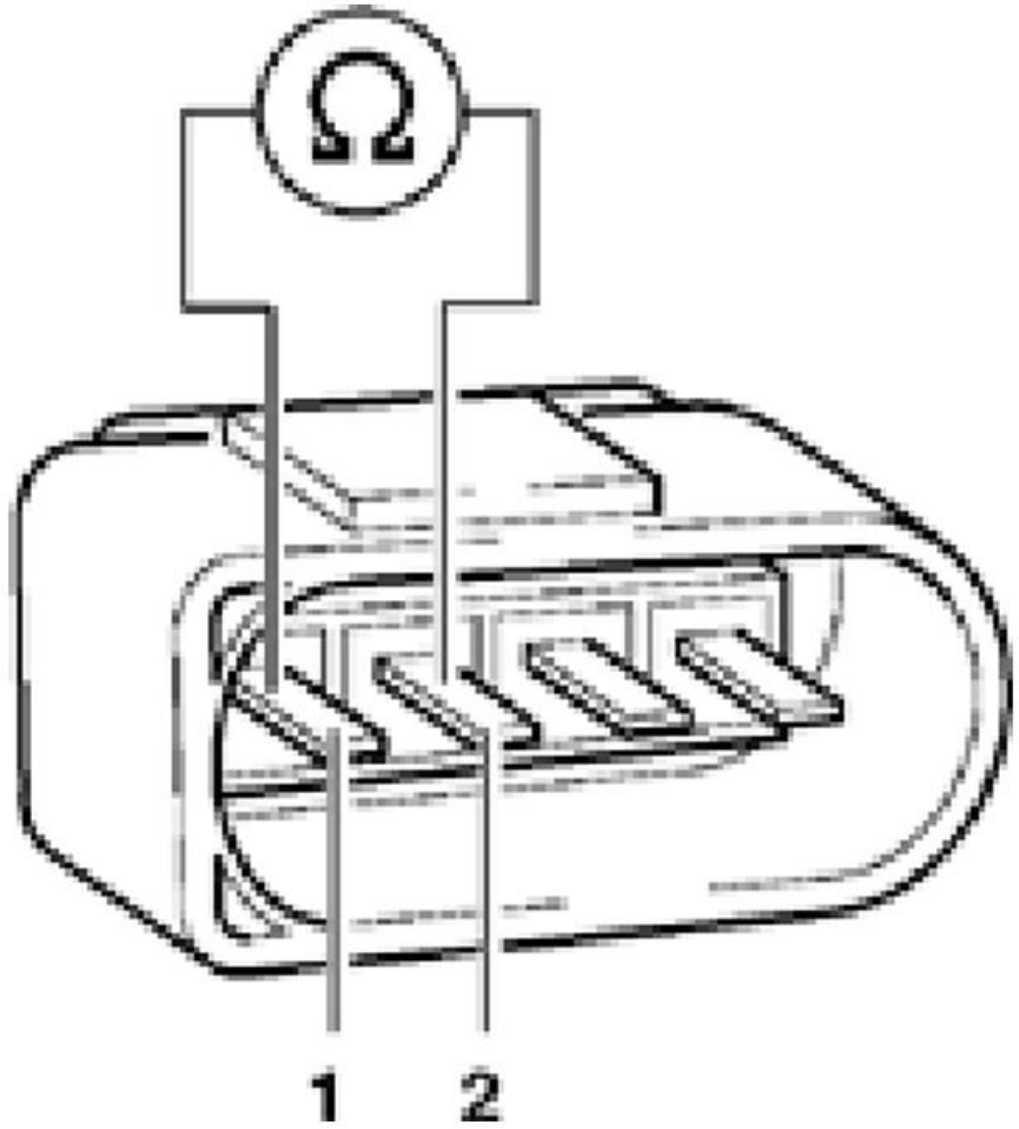


Fig. 22: Checking Resistance Between HO2S -G130- Terminals
Courtesy of VOLKSWAGEN OF AMERICA, INC.

If it is determined that Oxygen Sensor heating has an open circuit:

- Replace Oxygen Sensor (O2S) after Three Way Catalytic Converter (TWC) -G130-

- Check DTC Memory, if necessary, repair any malfunctions and then Erase DTC Memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING** .
- Read readiness code, see **READINESS CODE, DISPLAYING** . If DTC memory has been erased or Motronic Engine Control Module (ECM) -J220- was disconnected from battery positive, readiness code must be generated again, see **READINESS CODE, GENERATING**

If oxygen sensor heating has continuity:

Checking voltage supply

- Set multimeter to measure voltage and connect to terminal 1 (connector to Motronic Engine Control Module (ECM) -J220-) and Ground (GND).

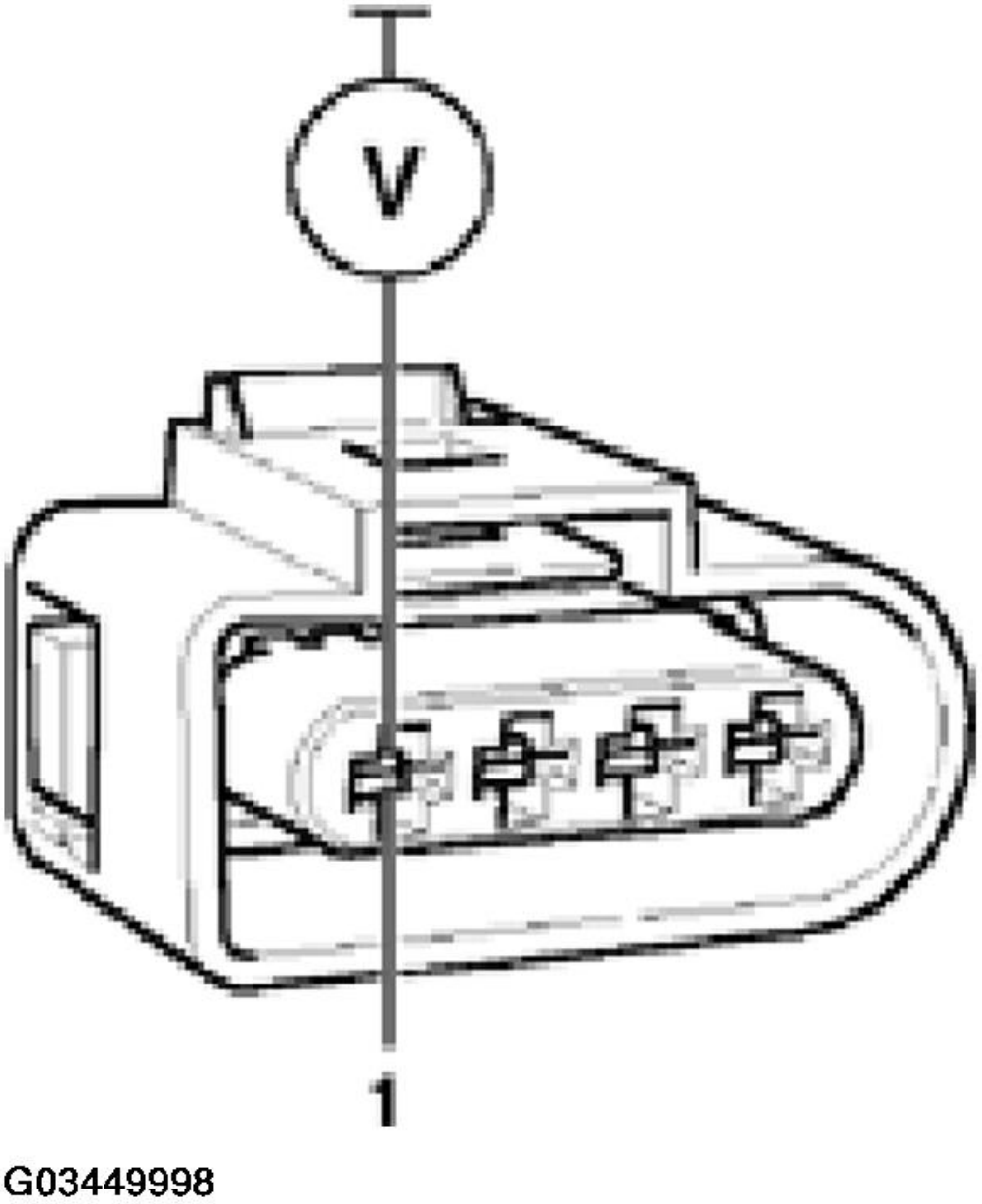


Fig. 23: Measuring Voltage Between HO2S -G130- Harness Connector Terminal 1 And Ground
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Start engine and run at idling speed.
- Check voltage supply:

Specification: 11.0 to 14.5 V

If no voltage is present:

- Check wiring from terminal 1 to Fuel Pump (FP) Relay -J17- according to Electrical Wiring Diagram.

If the specification is obtained:

- Connect multimeter using auxiliary cables from VAG 1594 to measure voltage at terminals 1 + 2 (connector to Motronic Engine Control Module (ECM) -J220-).

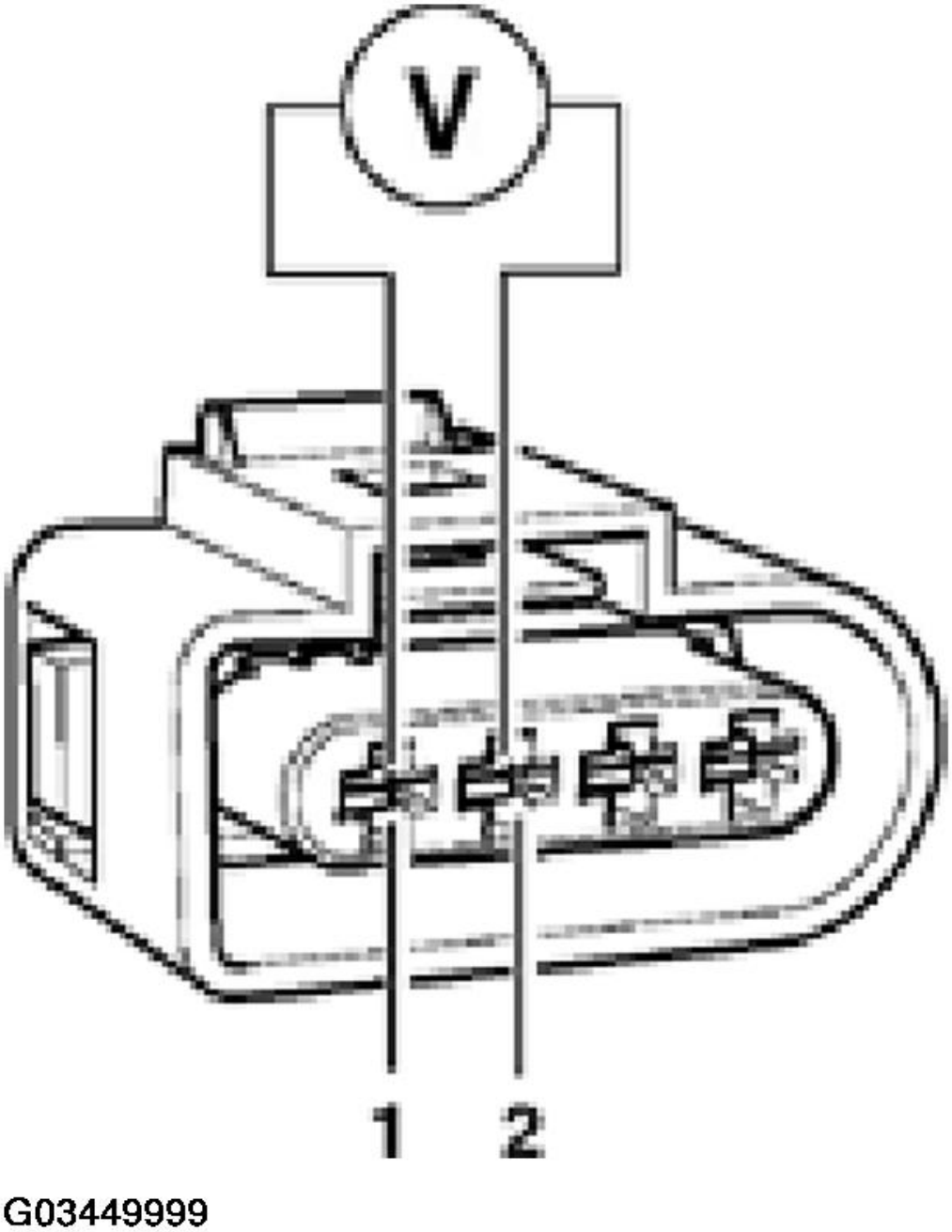


Fig. 24: Measuring Voltage Between HO2S -G130- Harness Connector Terminal 1 And 2
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Measure voltage supply and observe display group 41, display zone 4.

Display: Htg.aC.ON:

- Specification: 11.0 to 14.5 V

Display: Htg. aC.ON/Htg.aC.OFF (alternating):

- Specification: Between 0.0 to 12.0 V fluctuating

If no voltage is present:

- Switch off ignition.
- Remove inner plenum chamber cover, left:

See **PLENUM CHAMBER INNER COVER, REMOVING AND INSTALLING**

- Connect VAG 1598/31 test box to control module wiring harness. Motronic Engine Control Module (ECM) -J220- is not connected by this action.

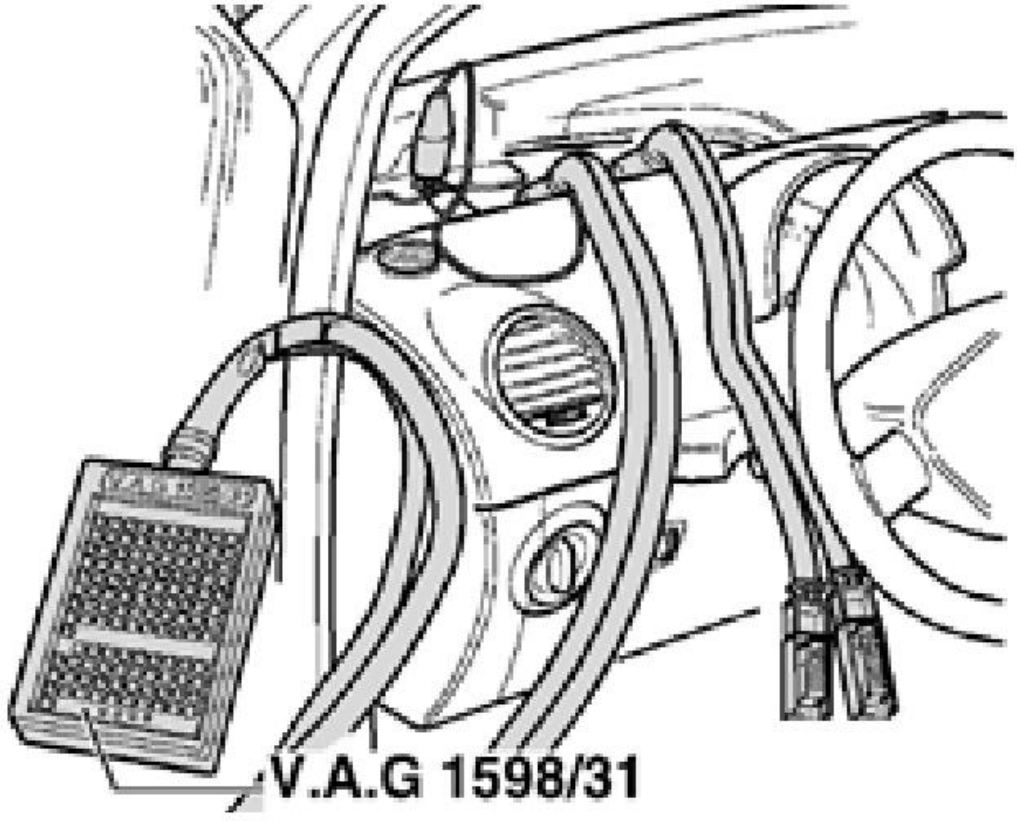


Fig. 25: Connecting VAG 1598/31 Test Box To Control Module Wiring Harness
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check wiring for open circuit between test box and 4 -pin connector according to Electrical Wiring Diagram.

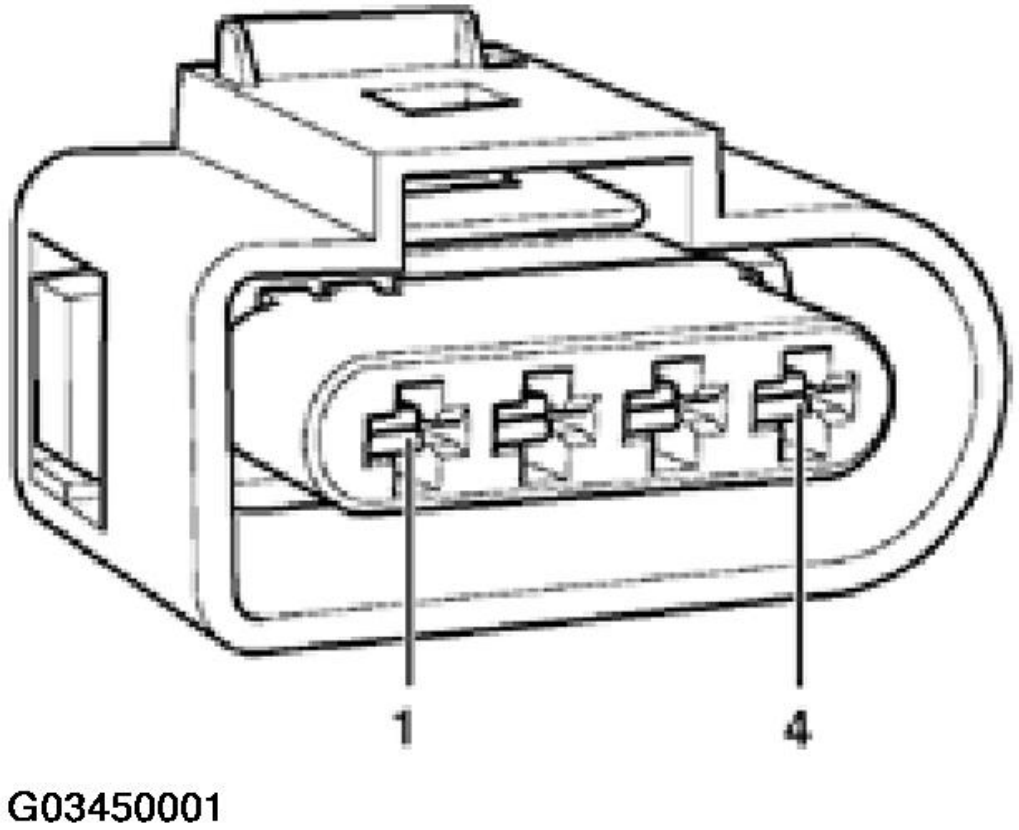


Fig. 26: Identifying HO2S -G130- Harness Connector Terminals
Courtesy of VOLKSWAGEN OF AMERICA, INC.

terminal 2 + socket 63:

- Wire resistance: Max. 1.5

If no wiring malfunction is found:

- Replace Motronic Engine Control Module (ECM) -J220-, see **MOTRONIC ENGINE CONTROL MODULE (ECM) - J220-, REPLACING** .

Mass Air Flow (MAF) sensor, checking

NOTE: Only gold-plated terminals can be used to repair terminals in the connector for the Mass Air Flow (MAF) sensor.

Special tools, test equipment and auxiliary items

- VAG 1551 scan tool or VAG 1552 mobile scan tool with VAG 1551/3B cable
- VAG 1598/31 test box
- VAG 1526 A or Fluke 83 multimeter
- VAG 1594 adapter set
- Electrical Wiring Diagram

Test conditions

- All fuses must be OK
- Battery voltage must be at least 11.5 V
- Fuel pump relay must be OK. Fuse holder is located behind access panel at far left end of dash.

Fig. 27: Locating Fuses
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- All electrical accessories, e.g. lights and rear window defroster, must be switched off
- If the vehicle is equipped with air conditioning, it must be turned off
- On vehicles with automatic transmission: selector lever in "P" or "N" position
- Engine Coolant Temperature (ECT) must be at least 80 °C, see display group 04, display zone 3

Test sequence

- Connect VAG 1551 scan tool ((VAG 1552). Start engine and select "Address word" 01 of Motronic Engine Control Module (ECM) -J220-. Engine must be running at idle speed. (Connecting scan tool and selecting Motronic Engine Control Module (ECM) -J220-, see **VAG 1551, CONNECTING AND**

SELECTING MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-).

Indicated on display

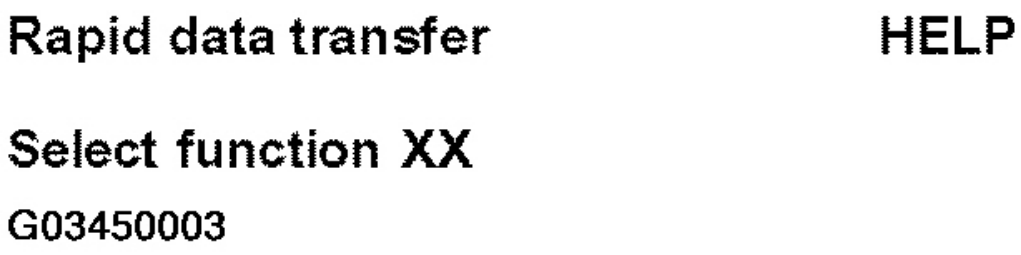


Fig. 28: Identifying Scan Tool Display - Checking MAF Sensor (1 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0- and -8- for function "Read measuring value block" and confirm entry with -Q- button.

  Indicated on display

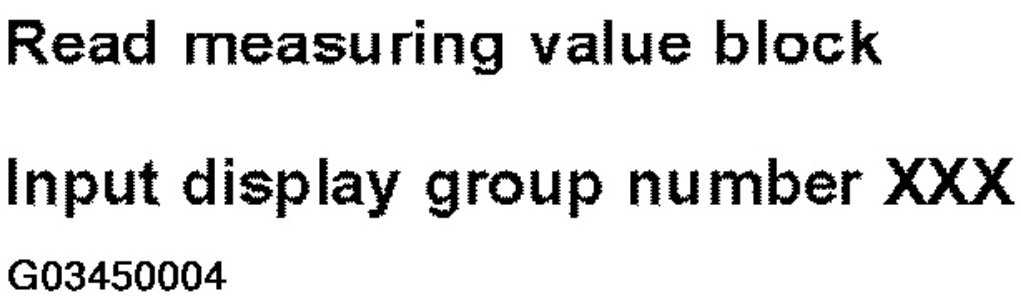


Fig. 29: Identifying Scan Tool Display - Checking MAF Sensor (2 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0-, -0- and -2- for "Display group number 2" and confirm entry with -Q- button.

  Indicated on display (1 to 4 Display zones)

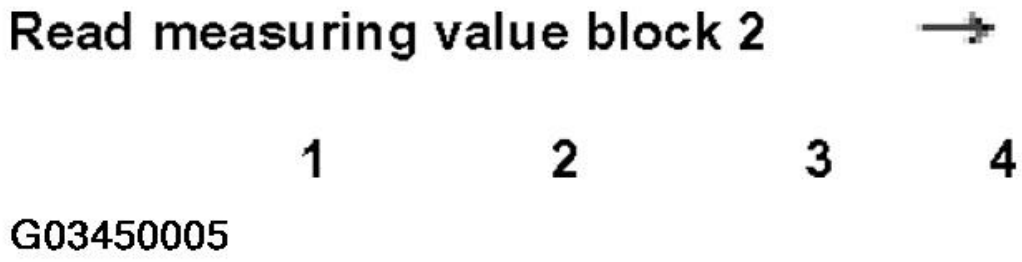


Fig. 30: Identifying Scan Tool Display - Checking MAF Sensor (3 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check Mass Air Flow drawn in display zone 4: Specification: 2.0 to 4.5 g/s

DISPLAY GROUP 2: LOAD REGISTRATION

	Display zones			
	1	**2**	**3**	**4**
Display group 2: Load registration				
Display	xxxx RPM	xxx.x %	xx.xx ms	**xxx.x g/s**
Indicated	Engine speed (in steps of 40)	Engine load	Injection period	**Mass Air Flow drawn in**
Operating range	0 to 6800/min.	12.0 to 175.0%	0.0 to 2.0 ms	2.0 to 177.0 g/s
Specification	760--810 RPM (1) 700-750 RPM (2)	12.0 to 25.0%	1.5 to 4.0 ms	2.0 to 4.5 g/s
(1) Engine idling at normal operating temperature for manual transmission (2) Engine idling at normal operating temperature for automatic transmission				

- If value is as specified but DTC memory has recorded a DTC relating to Mass Air Flow (MAF) sensor, test power supply to Mass Air Flow (MAF) sensor, see **TESTING POWER SUPPLY TO MASS AIR FLOW (MAF) SENSOR -G70-** .

  If the specification is not obtained:

- Check signal and Ground (GND) wires for Mass Air Flow (MAF) sensor, see **TESTING SIGNAL AND GROUND (GND) WIRES FOR MASS AIR FLOW (MAF) SENSOR -G70-** .

  If the specification is obtained:

- Press --> button.
- Press buttons -0- and -6- for function "End output" and confirm entry with -Q- button.
- Switch off ignition.

Testing power supply to Mass Air Flow (MAF) sensor -G70-

- Disconnect 5-pin connector -1- from Mass Air Flow (MAF) sensor -G70- arrow.

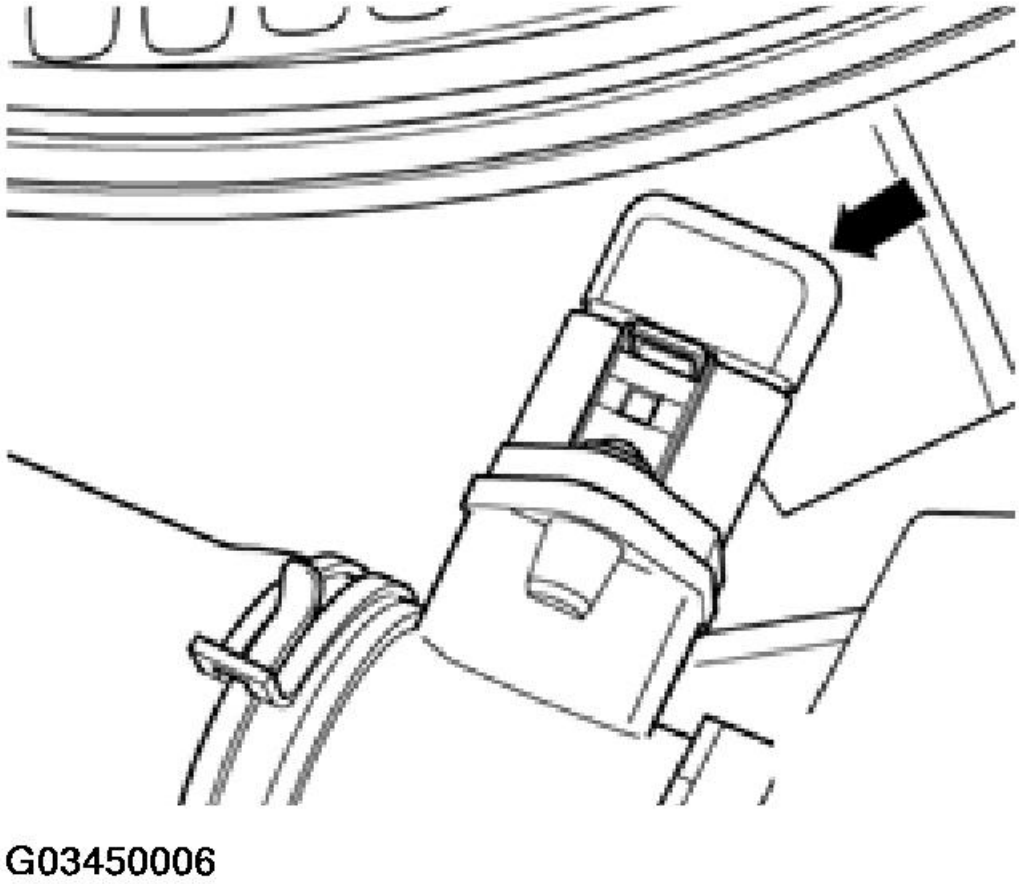


Fig. 31: Disconnecting Pin Connector From Mass Air Flow (Maf) Sensor
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Connect multimeter to measure voltage on connector terminal 2 and engine Ground (GND).

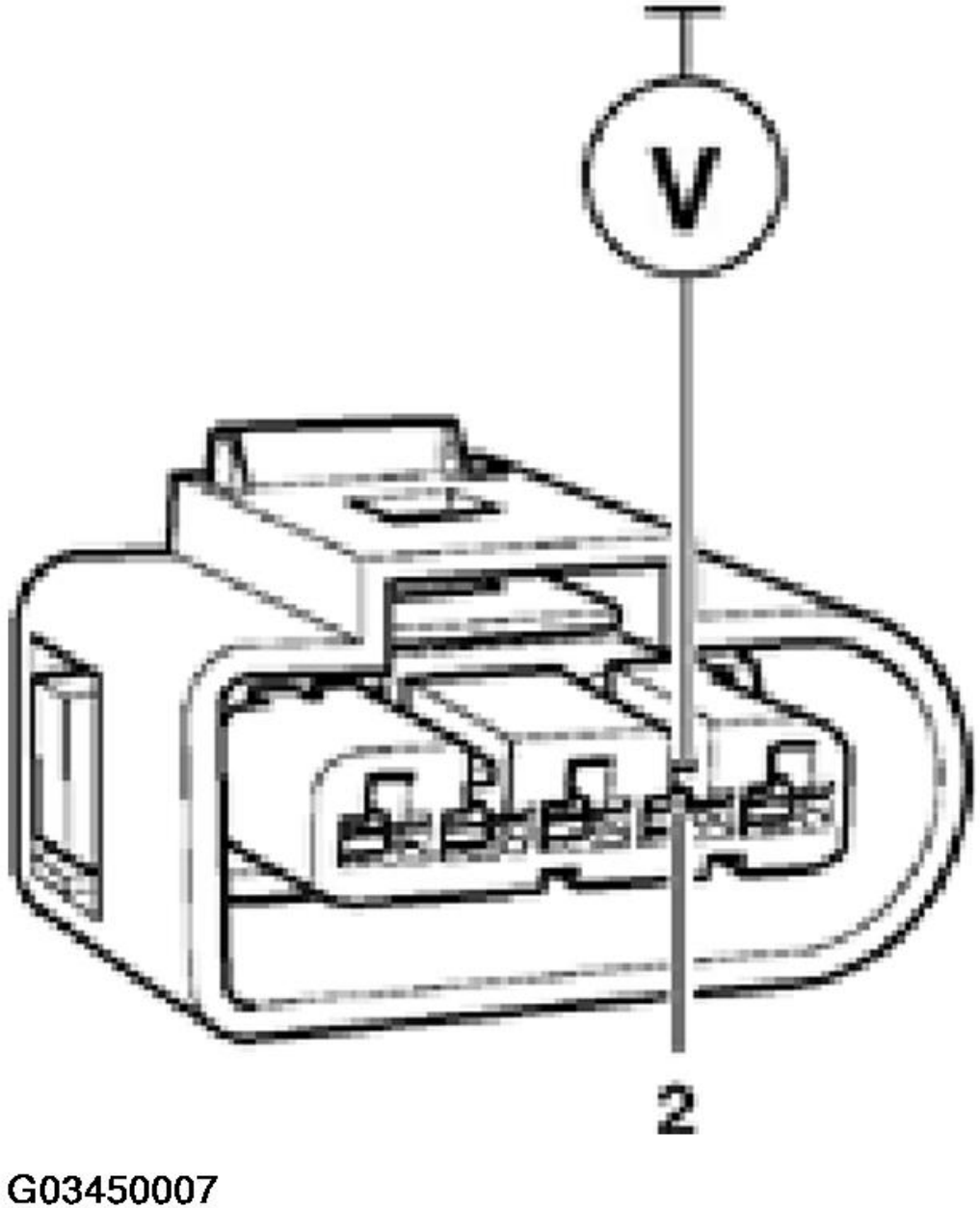


Fig. 32: Measuring Voltage Between Terminal 2 And Ground On MAF Sensor Harness Connector
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Start engine and run at idle speed.

Specification: 11.0 to 15.0 V

If no voltage is present:

- Switch off ignition.
- Check wire between 5 -pin connector terminal 2 and Fuel Pump (FP) Relay -J17- for open circuit using Electrical Wiring Diagram.

  Wire resistance: max. 1.5

If the voltage supply and wiring is OK:

- Connect multimeter to measure voltage on connector terminal 4 and engine Ground (GND).

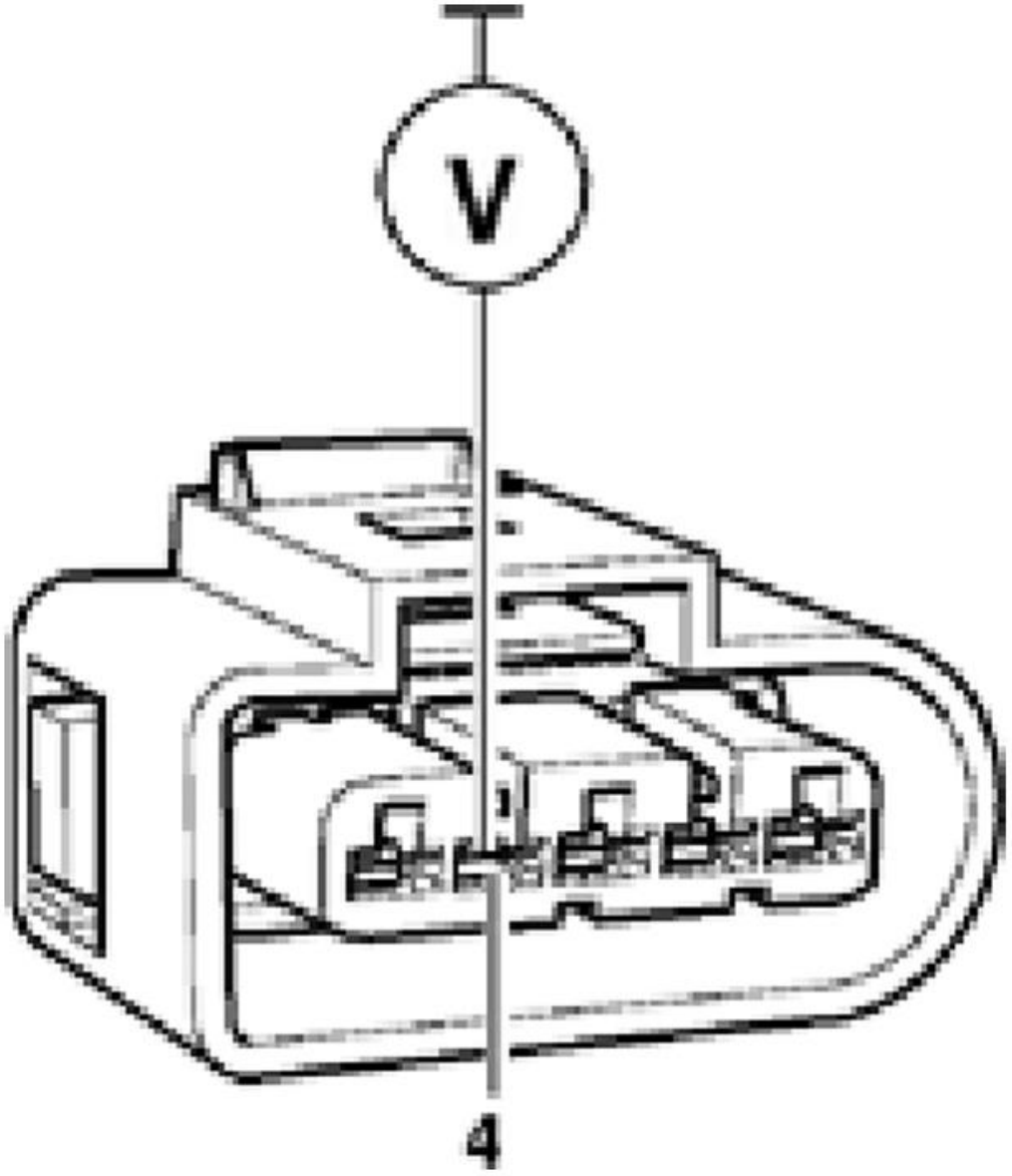


Fig. 33: Measuring Voltage Between Terminal 4 And Ground On MAF Sensor Harness Connector
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Switch on ignition.

Specification: 4.5 to 5.5 V

If no voltage is present:

- Switch off ignition.
- Check signal and Ground (GND) wires, see **TESTING SIGNAL AND GROUND (GND) WIRES FOR MASS AIR FLOW (MAF) SENSOR -G70-** .

Testing signal and Ground (GND) wires for Mass Air Flow (MAF) sensor -G70-

- Remove inner plenum chamber cover, left:

  See **PLENUM CHAMBER INNER COVER, REMOVING AND INSTALLING**

- Connect VAG 1598/31 test box to control module wiring harness. Motronic Engine Control Module (ECM) -J220- is not connected by this action.

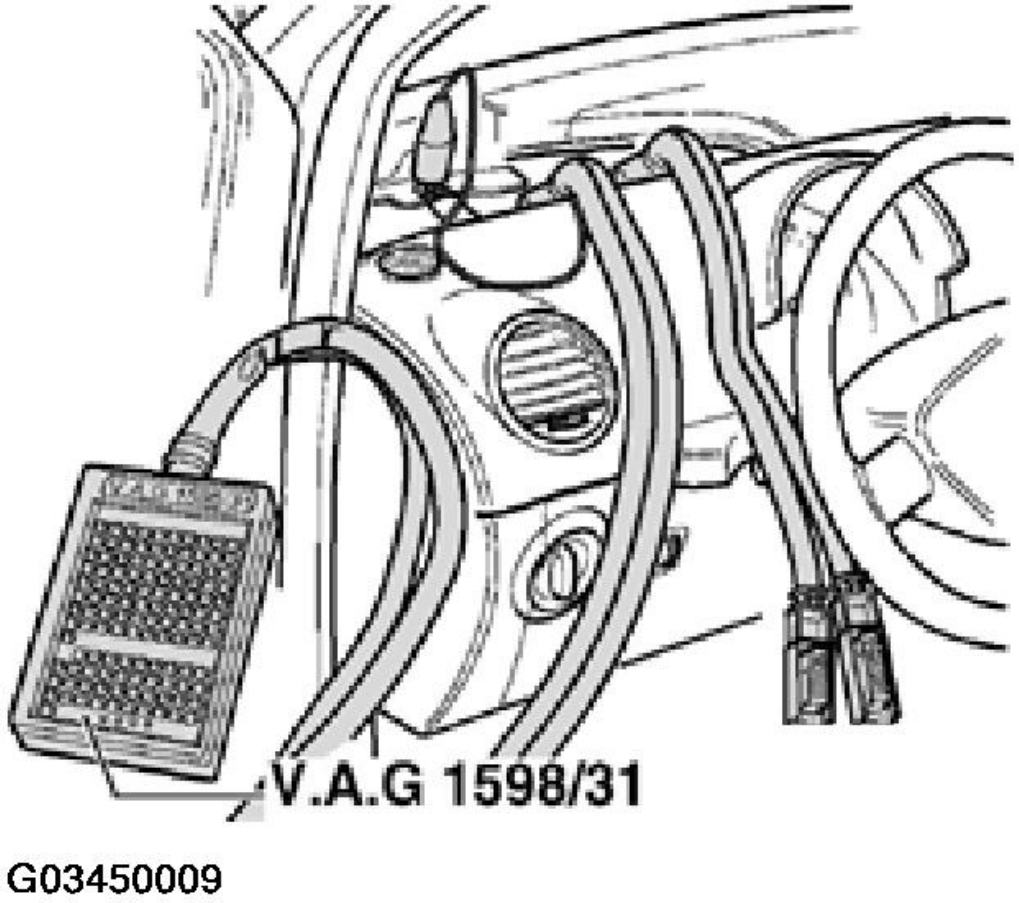


Fig. 34: Connecting VAG 1598/31 Test Box To Control Module Wiring Harness
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check wiring for open circuit between test box and 5 -pin connector using Electrical Wiring Diagram.
  - terminal 5 + socket 29
  - terminal 4 + socket 53
  - terminal 3 + socket 27

  Wire resistance: Max. 1.5

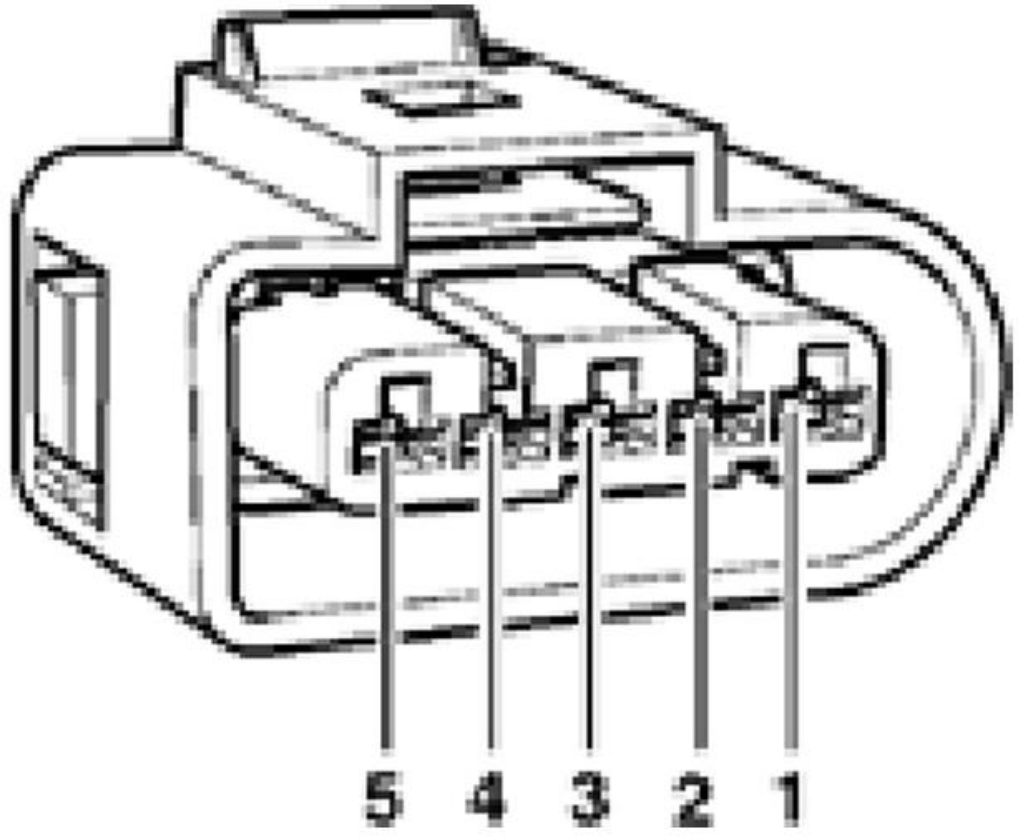


Fig. 35: Identifying MAF Sensor Harness Connector Terminals
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Additionally check wires all for short to one another.

  Specification:

- Check wiring additionally for short circuit to battery positive/Ground (GND).

NOTE: Socket 1 in Mass Air Flow (MAF) sensor and connector is not occupied.

If no wiring malfunction is found:

- Replace Mass Air Flow (MAF) sensor -G70-, see item 2 .

- Check DTC Memory, if necessary, repair any malfunctions and then Erase DTC Memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING** .
- Read readiness code, see **READINESS CODE, DISPLAYING** . If DTC memory has been erased or Motronic Engine Control Module (ECM) -J220- was disconnected from battery positive, readiness code must be generated again, see **READINESS CODE, GENERATING** .

Throttle Valve Control Module -J338-, checking

Components of Throttle Valve Control Module - J338-: Throttle valve drive -G186-, Angle sensor 1 for throttle valve drive -G187- and Angle sensor 2 for throttle valve drive -G188-.

NOTE:

- **If the Throttle Valve Control Module -J338- is replaced, the new control module must be adapted to the Motronic Engine Control Module (ECM) -J220-, see MOTRONIC ENGINE CONTROL MODULE (ECM) - J220- TO THROTTLE VALVE CONTROL MODULE - J338-, ADAPTING .**
- **On vehicles with an automatic transmission, the transmission control module must also be adapted:**

See **DIAGNOSIS - 01M**

Special tools, test equipment and auxiliary items

- VAG 1551 scan tool or VAG 1552 mobile scan tool with VAG 1551/3B cable
- VAG 1598/31 test box
- VAG 1526 A or Fluke 83 multimeter
- VAG 1594 adapter set
- Electrical Wiring Diagram

Test conditions

- Engine not running, ignition switch on
- Throttle valve not damaged or dirty
- On vehicles with automatic transmission selector lever in "P" or "N" position
- Engine Coolant Temperature (ECT) must be at least 80 °C display group 04, display zone 3

NOTE: Only gold-plated terminals can be used to repair the terminals in the connector for the Throttle Valve Control Module -J338-.

- Connect VAG 1551 scan tool (or VAG 1552). Switch ignition on and select Motronic Engine Control Module (ECM) -J220- with "Address word" 01. Connecting scan tool and selecting Motronic Engine Control Module (ECM) -J220-, see **VAG 1551, CONNECTING AND SELECTING MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-** .

Indicated on display

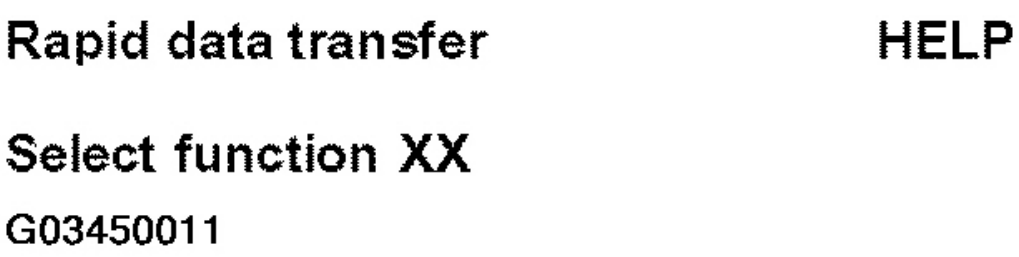


Fig. 36: Identifying Scan Tool Display - Checking Throttle Valve Control Module (1 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0- and -8- for function "Read measuring value block" and confirm entry with -Q- button.

  Indicated on display

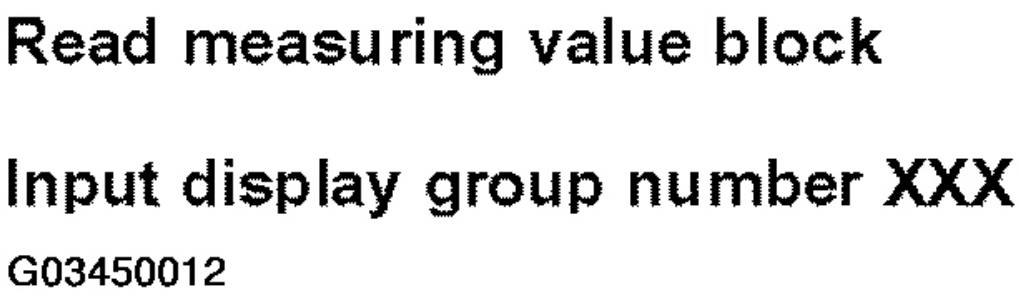


Fig. 37: Identifying Scan Tool Display - Checking Throttle Valve Control Module (2 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0-, -6- and -2- for "Display group number 62" and confirm entry with -Q- button.

Indicated on display (1 to 4 Display zones)

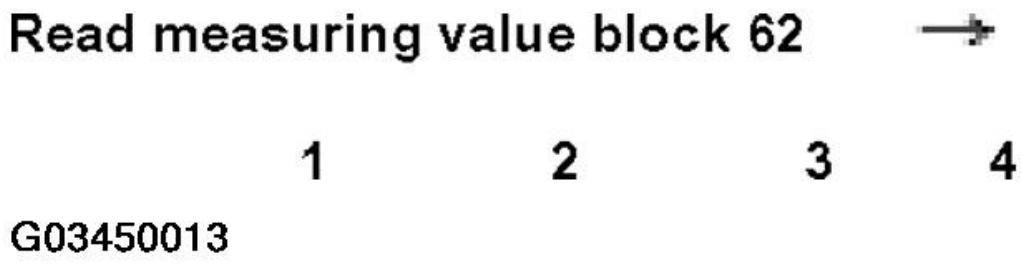


Fig. 38: Identifying Scan Tool Display - Checking Throttle Valve Control Module (3 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check throttle valve angle at idling stop from Throttle valve angle sensor 1 -G187- in display zone 1:

  Specification: 10 to 88%

- Check throttle valve at idling stop from Throttle valve angle sensor 2 -G188- in display zone 2:

Specification: 89 to 11%

DISPLAY GROUP 62: SPEED CONTROL, ELECTRONIC POWER CONTROL (EPC)

	Display zones			
	1	**2**	**3**	**4**
Display group 62: Speed control, Electronic Power Control (EPC)				
Display	xxx %	xxx %	xxx %	xxx %
Indicated	Throttle valve angle sensor 1 -G187-	Throttle valve angle sensor 2 -G188-	Throttle Position (TP) sensor 1 -G79-	Throttle Position (TP) sensor 2 -G185-
Working range	0 to 100%	0 to 100%	0 to 100%	0 to 100%
Specification	10 to 88%	89 to 11%	10 to 18%	5 to 9%
	If specifications are not achieved, see **CHECKING VOLTAGE SUPPLY AND WIRING TO CONTROL MODULE** , Continuation		-	-

- Depress accelerator slowly until full throttle position and observe angles displayed in display zones 1 and 2:

- Percent figure in display zone 1 must rise continuously and evenly. Full tolerance range 10 to 88% is not always displayed.

- Percent figure in display zone 2 must fall continuously and evenly. Full tolerance range 89 to 11% is not always displayed.

NOTE:

- **The reason why the display in display zone 1 rises and the display in display zone 2 falls is because the potentiometers (angle sensors) in the angle sensors run in opposite directions.**
- **The voltage of angle sensor 1 moves toward 5 volts. (The more the throttle valve is opened the higher the voltage; percentage increases).**
- **While the voltage of angle sensor 2 drops from 5 volts toward 0 volt. (The more the throttle valve is opened the lower the voltage; percentage falls).**

If the specifications are obtained:

- Press --> button.
- Press buttons -0- and -6- for function "End output" and confirm entry with -Q- button.
- Switch off ignition.

Continuation

If the displays do not indicate as described:

- Press --> button.
- Press buttons -0- and -6- for function "End output" and confirm entry with -Q- button.
- Switch off ignition.
- Disconnect 6-pin connector from Throttle Valve Control Module - J338- -arrow-.

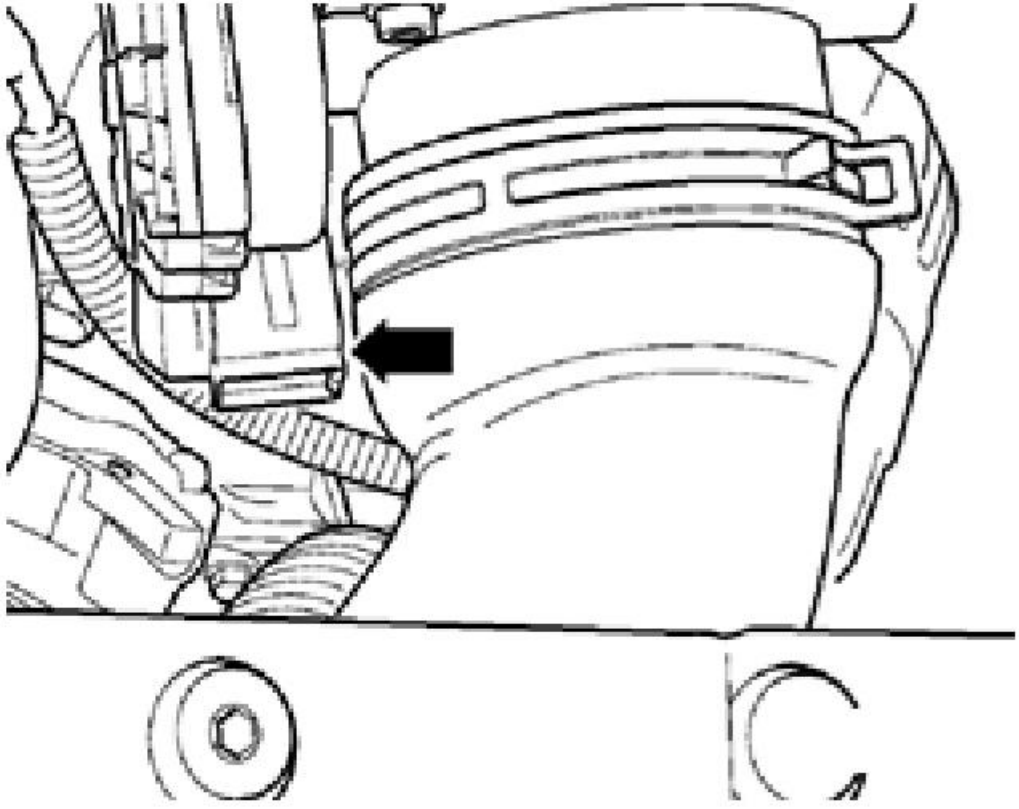


Fig. 39: Disconnecting Pin Connector From Throttle Valve Control Module
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Measure resistance from throttle valve drive between terminals 3 and 5

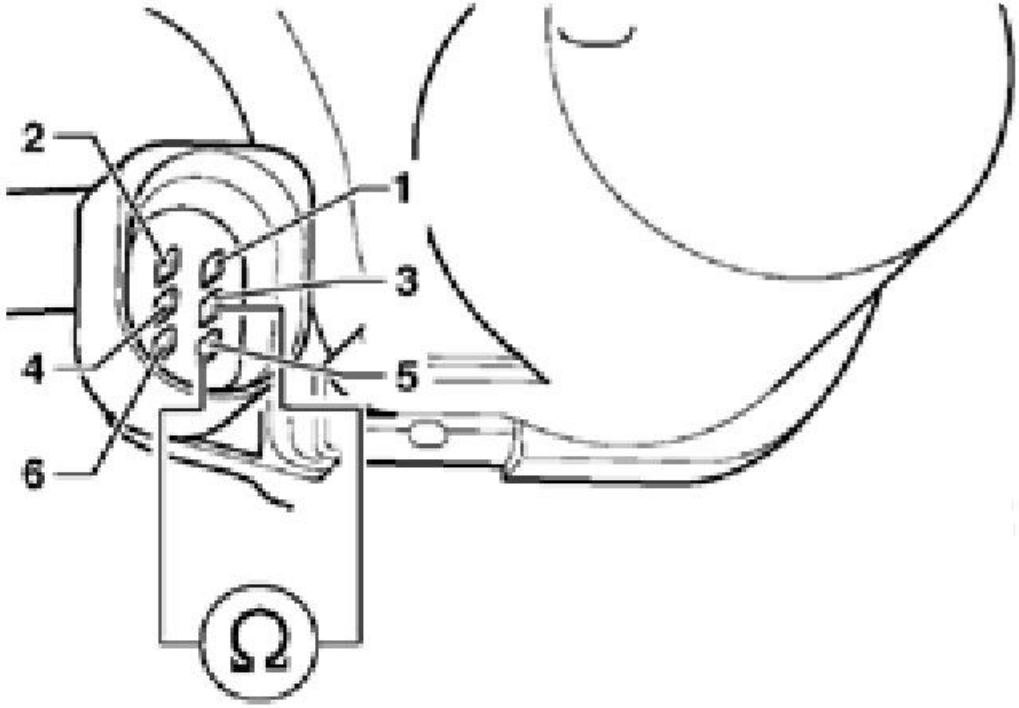


Fig. 40: Measuring Resistance From Throttle Valve Drive Between Terminals 3 And 5
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Specification: 1.0 to 5.0

If the specification is not obtained:

- Replace Throttle Valve Control Module -J338-, see item 22 .
- Check DTC Memory, if necessary, repair any malfunctions and then Erase DTC Memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING** .
- Adapt Motronic Engine Control Module (ECM) -J220- to Throttle Valve Control Module -J338-, see **MOTRONIC ENGINE CONTROL MODULE (ECM) - J220- TO THROTTLE VALVE CONTROL MODULE - J338-, ADAPTING** .

- Read readiness code, see **READINESS CODE, DISPLAYING** . If DTC memory has been erased or Motronic Engine Control Module (ECM) -J220- was disconnected from battery positive, readiness code must be generated again, see **READINESS CODE, GENERATING** .

If the specification is obtained:

- Check voltage supply of Throttle Valve Control Module -J338- and wiring to control module, see **CHECKING VOLTAGE SUPPLY AND WIRING TO CONTROL MODULE** .
- Check Throttle Position (TP) sensors (EPC).

  See **THROTTLE POSITION (TP) SENSOR, CHECKING**

  If the voltage supply and wiring is OK:

- Replace Motronic Engine Control Module (ECM) -J220-, see **MOTRONIC ENGINE CONTROL MODULE (ECM) - J220-, REPLACING** .

Checking voltage supply and wiring to control module

- Disconnect 6-pin connector from Throttle Valve Control Module - J338- -arrow-.

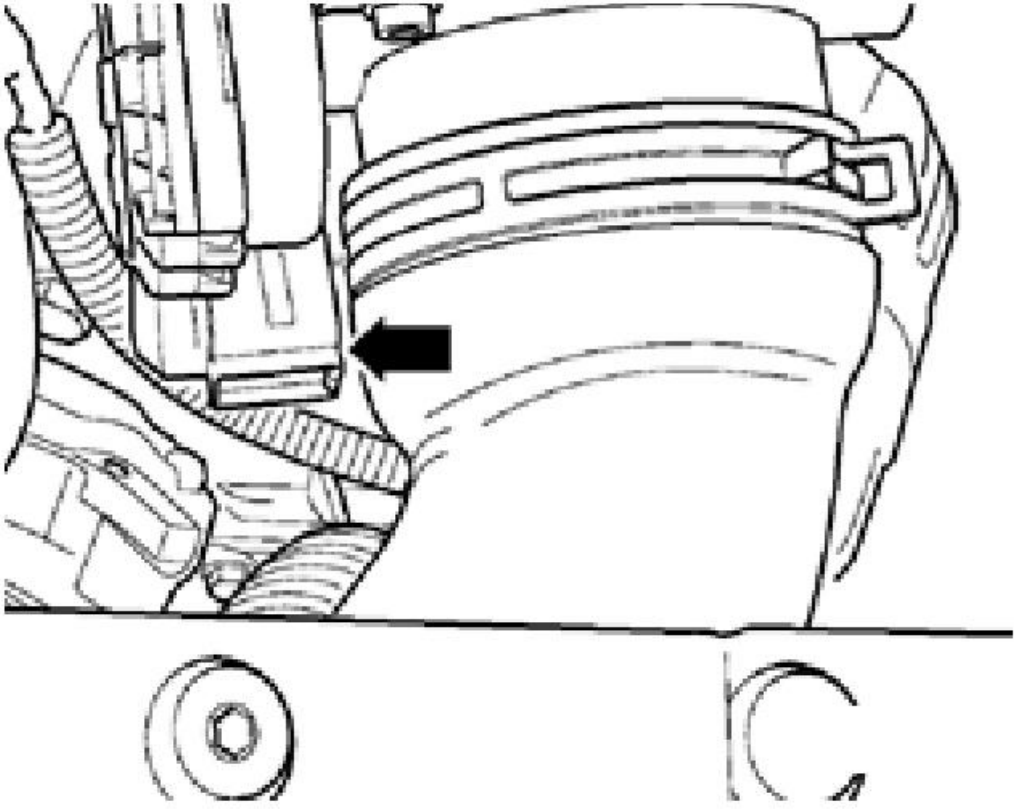
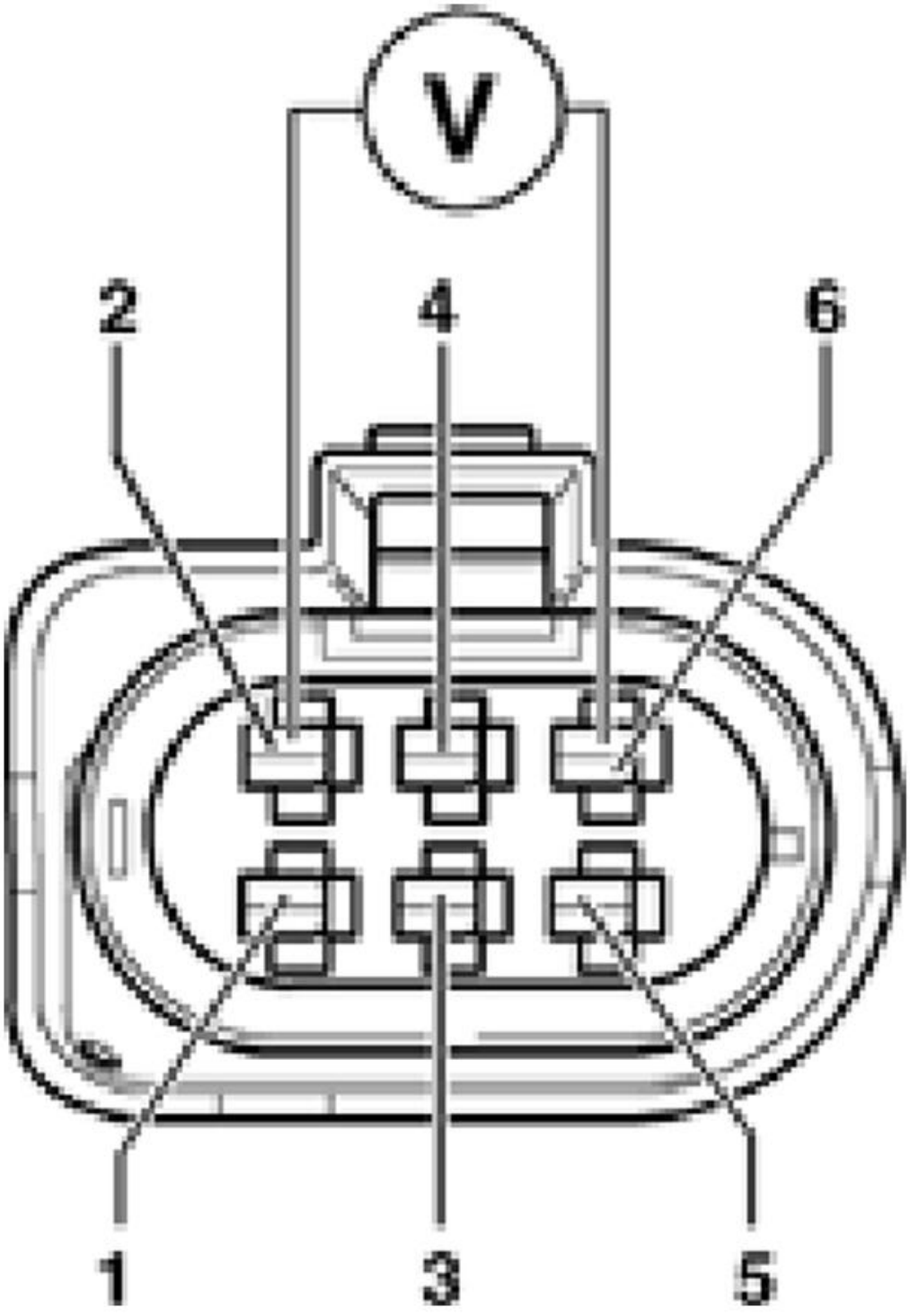


Fig. 41: Disconnecting 6-Pin Connector From Throttle Valve Control Module
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Connect multimeter to measure voltage to terminals 2 + 6 of connector.
- Switch on ignition.

  Specification: min. 4.5 V

- Switch off ignition.

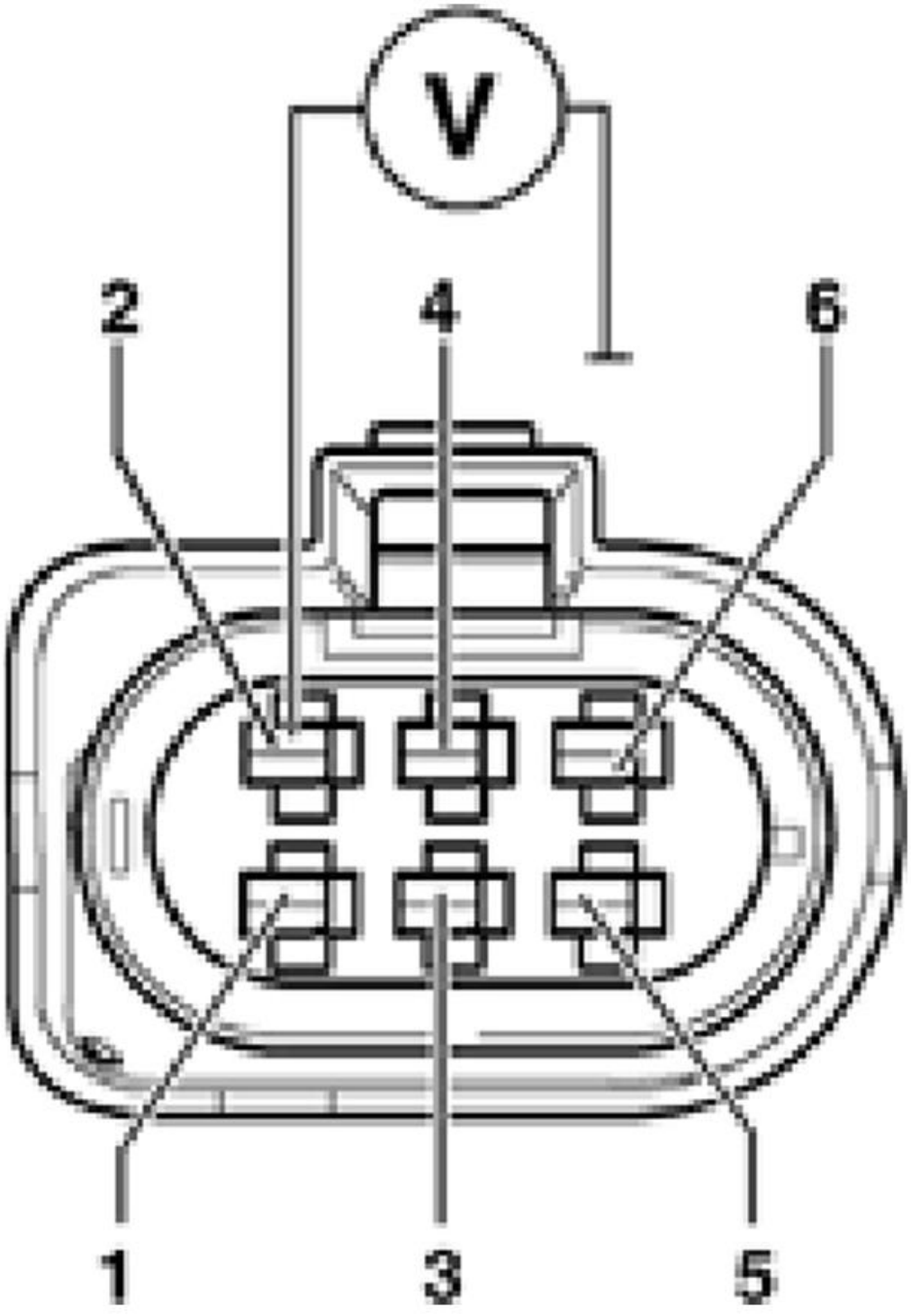


G03450017

Fig. 42: Measuring Voltage Between Terminals 2 And 6 Of Throttle Valve Control Module Harness Connector
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Connect multimeter to measure voltage at connector terminal 2 and Ground (GND).
- Switch on ignition.

Specification: min. 4.5 V



G03450018

Fig. 43: Measuring Voltage Between Terminals 2 And Ground Of Throttle Valve Control Module Harness Connector
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Switch off ignition.

If the specifications are not obtained:

- Remove inner plenum chamber cover, left:

See **PLENUM CHAMBER INNER COVER, REMOVING AND INSTALLING**

- Connect VAG 1598/31 test box to control module wiring harness. Motronic Engine Control Module (ECM) -J220- is not connected by this action.

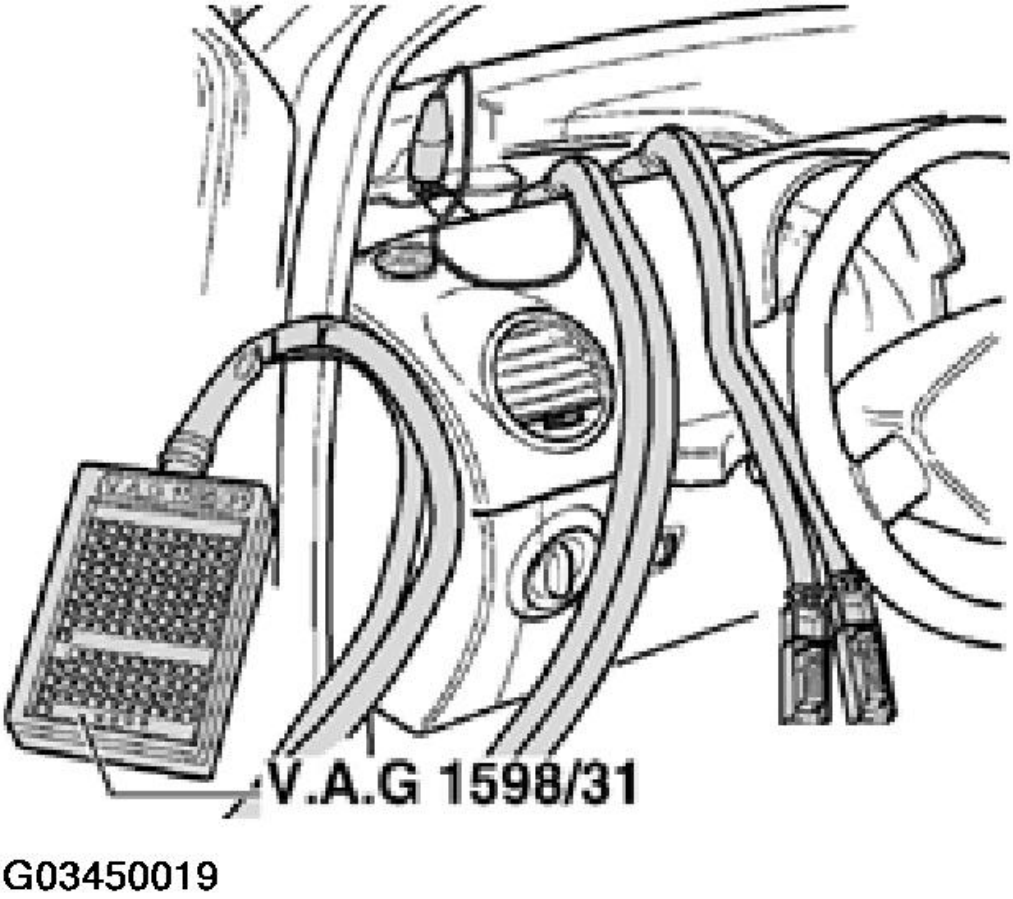


Fig. 44: Connecting VAG 1598/31 Test Box To Control Module Wiring Harness
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check wiring between test box and connector terminals for open circuit using Electrical Wiring Diagram:
  - terminal 1 + Socket 92
  - terminal 2 + Socket 83
  - terminal 3 + Socket 117
  - terminal 4 + Socket 84
  - terminal 5 + Socket 118
  - terminal 6 + Socket 91

Wire resistance: max. 1.5

- Additionally check wires for short to one another.

  Specification: INFINITY ohm

- Check wiring additionally for short circuit to battery positive or Ground (GND).

Specification: INFINITY ohm

If no wiring malfunction is found:

- Check Motronic Engine Control Module (ECM) -J220- voltage supply, see **MOTRONIC ENGINE CONTROL MODULE (ECM)** .

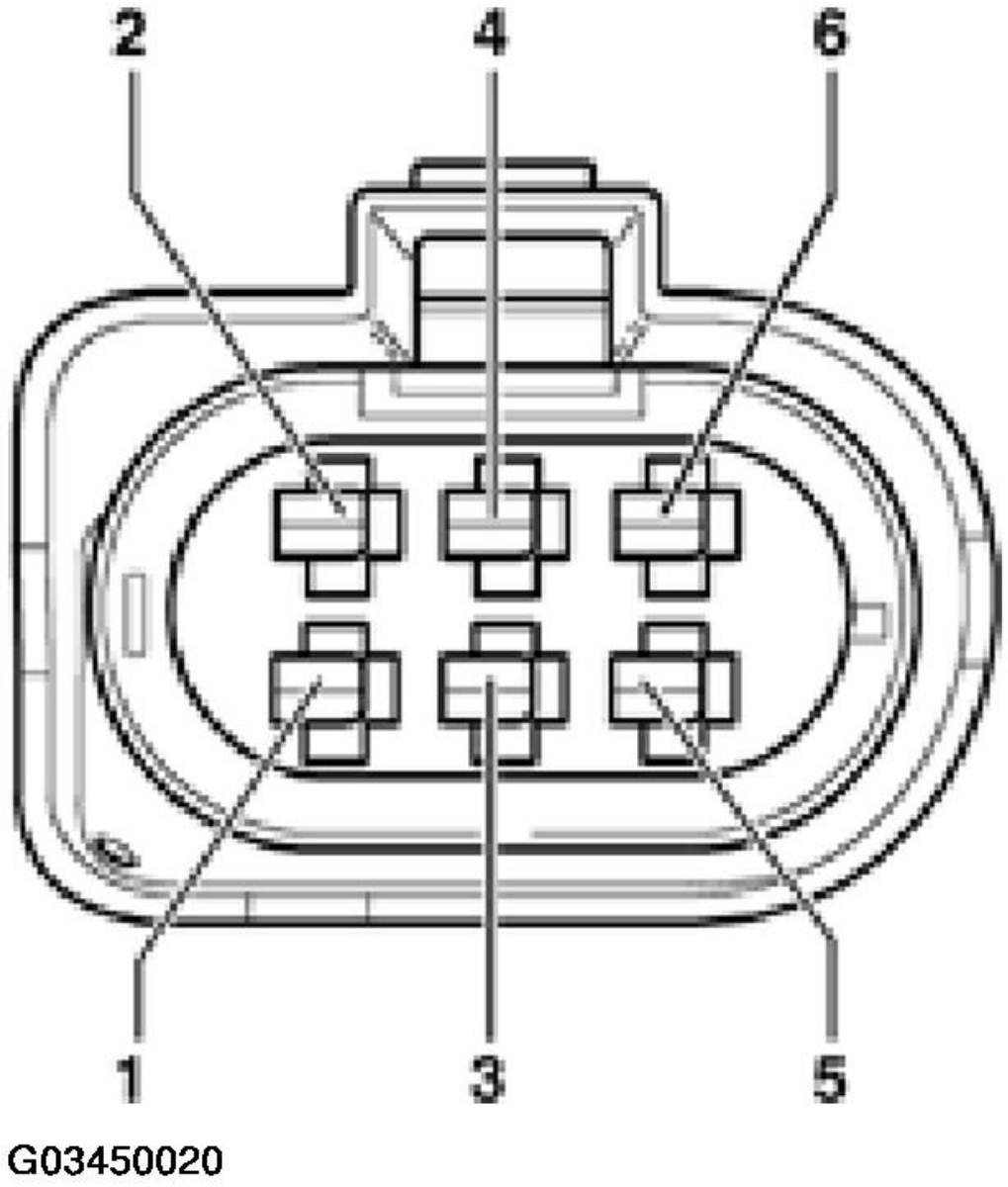


Fig. 45: Identifying Throttle Valve Control Module Harness Connector Terminals
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Engine Coolant Temperature (ECT) sensor -G62-, checking

NOTE: The Motronic Engine Control Module (ECM) - J220- will use a replacement temperature value for an engine start as soon as there is a DTC stored in the

DTC memory which affects the Engine Coolant Temperature (ECT) sensor - G62-. The temperature then rises according to a model stored in the ECM. When the engine has reached normal working temperature a fixed replacement value will be displayed after a certain period. This fixed value is also dependent on intake air temperature.

Special tools, test equipment and auxiliary items

- VAG 1551 scan tool or VAG 1552 mobile scan tool with VAG 1551/3B cable
- VAG 1598/31 test box
- VAG 1526 A or Fluke 83 multimeter
- VAG 1594 adapter set
- Electrical Wiring Diagram

Test conditions

- Engine must be cold

Test sequence

NOTE: Only gold-plated terminals must be used to repair the terminals 3 and 4 in the connector for the Engine Coolant Temperature (ECT) sensor.

- Connect VAG 1551 scan tool ((VAG 1552). Switch ignition on and select Motronic Engine Control Module with "Address word" 01. Connecting scan tool and selecting Motronic Engine Control Module (ECM) -J220-, see **VAG 1551, CONNECTING AND SELECTING MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-** .

Indicated on display

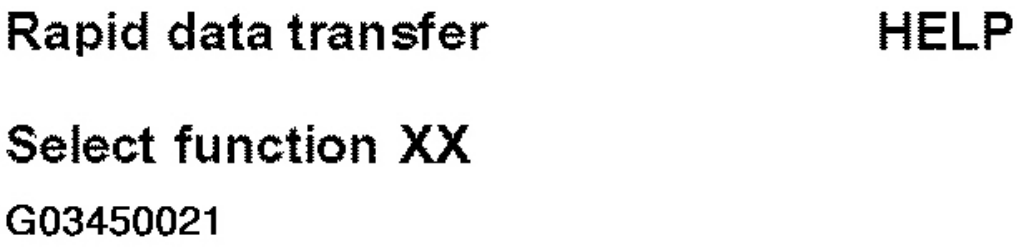


Fig. 46: Identifying Scan Tool Display - ECT Sensor, Checking (1 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0- and -8- for function "Read measuring value block" and confirm entry with -Q- button.

  Indicated on display

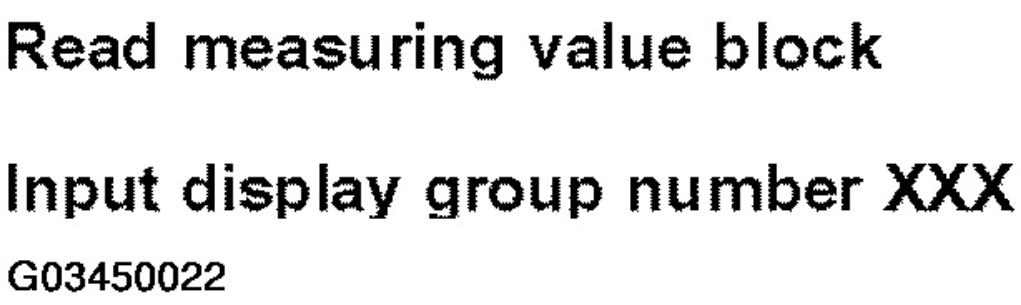


Fig. 47: Identifying Scan Tool Display - ECT Sensor, Checking (2 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0-, -0- and -4- for "Display group number 4" and confirm entry with -Q- button.

  Indicated on display (1 to 4 Display zones)

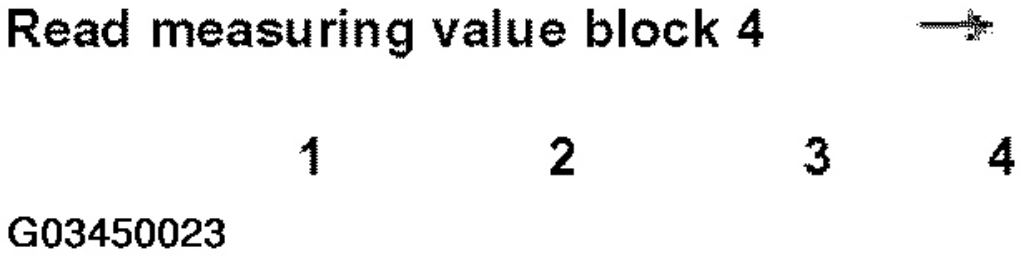


Fig. 48: Identifying Scan Tool Display - ECT Sensor, Checking (3 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Read Engine Coolant Temperature (ECT) value in display zone 3. Specification: approx. Engine Coolant Temperature (ECT)

DISPLAY GROUP 4: GENERAL ENGINE DATA

	Display zones			
	1	**2**	**3**	**4**
Display group 4: General engine data				
Display	xxxx RPM	xx.xxx V	xxx.x °C	xxx.x °C
Indicated	Engine speed (in steps of 40)	Supply voltage for Motronic Engine Control Module (ECM) -J220-	Engine Coolant Temperature (ECT)	Intake air temperature
Working range	0 to 6800 RPM	12.000 to 15.000 V	-48.0 to 143.0 °C	-48.0 to 143.0 °C
Specification	760 to 810 RPM (1) 700 to 750 RPM (2)	12.000 to 15.000 V	Approx. ambient air temperature (3)	-
	-	-	If the specifications are not obtained, see **CONTINUATION OF CHECK WHEN DISPLAY APPROX. - 48 °C:** , Evaluating display group 4	-

(1) Engine idling at normal operating temperature for manual transmission

(2) Engine idling at normal operating temperature for automatic transmission

(3) If a temperature is displayed which deviates greatly from the ambient temperature of the sensor, check sensor wiring for transfer resistances/open circuit.

If the specification is not obtained:

- Perform check according to following table:

Evaluating display group 4, display zone 3 - Engine Coolant Temperature (ECT)

EVALUATING DISPLAY GROUP 4, DISPLAY ZONE 3 - ENGINE COOLANT TEMPERATURE (ECT)

Display group: 4 **Display zone: 3**	**Possible cause**	**Corrective action**
Approx. -48.0 °C (1)	• Wiring open circuit or short to positive	• Continuation, see **CONTINUATION OF CHECK WHEN DISPLAY APPROX. - 48 °C:**
Approx. 143.0 °C (1)	• Short to Ground (GND)	• Continuation, see **CHECKING WIRING**

(1) If a temperature is displayed which deviates greatly from the ambient temperature of the sensor, check sensor wiring for transfer resistances. Note when doing this that sensor is heated from external sources, e.g. radiated heat when engine is not running.

If the specification is obtained:

- Start engine and run at idling speed.

  Temperature value must increase uniformly

  NOTE:

  - **Temperature increases in steps of 1.0 C.**
  - **If irregular engine running occurs in certain temperature ranges and the temperature figure does not increase without interruption, the temperature signal is temporarily interrupted and the sensor must be replaced.**

- Press --> button.
- Press buttons -0- and -6- for "End output" function and confirm input with -Q- button.

Continuation of check when display approx. - 48 °C:

- Disconnect 4-pin connector from Engine Coolant Temperature (ECT) sensor -G62- with Engine Coolant Temperature (ECT) sensor -G2- -arrow-.

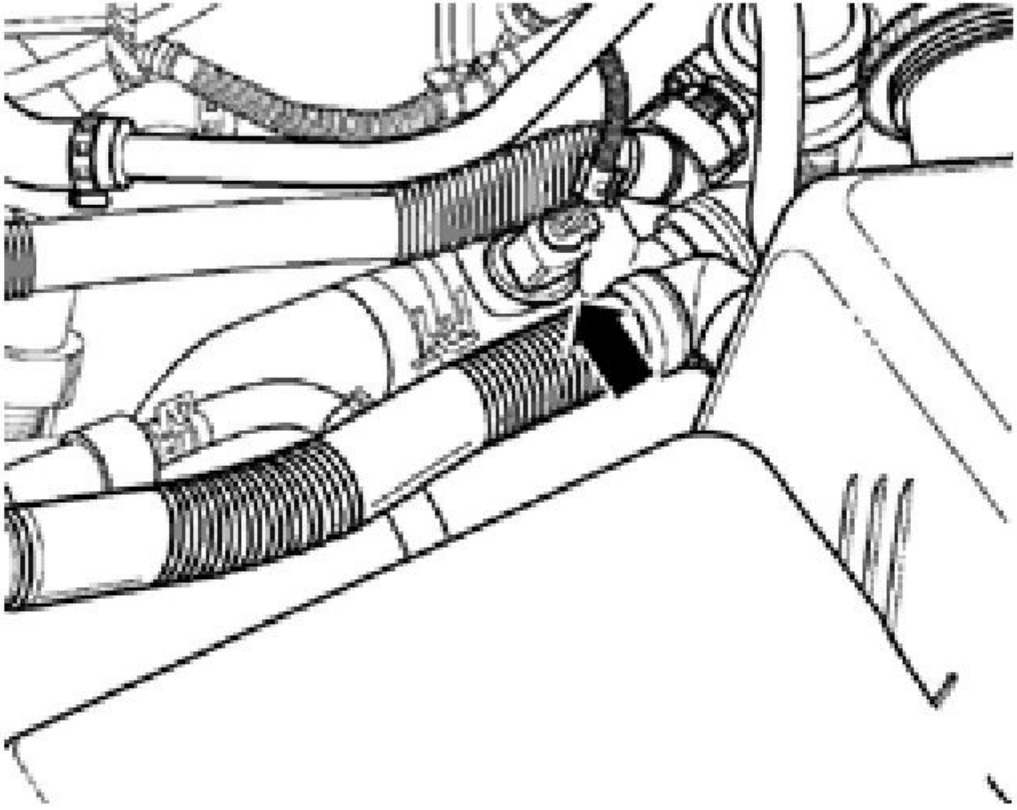


Fig. 49: Disconnecting Pin Connector From Engine Coolant Temperature (ECT) Sensor With Engine Coolant Temperature (ECT) Sensor
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Bridge connector terminals 3 + 4 using auxiliary cables from VAG 1594 and observe display.

  If display jumps to approx. 143.0 °C:

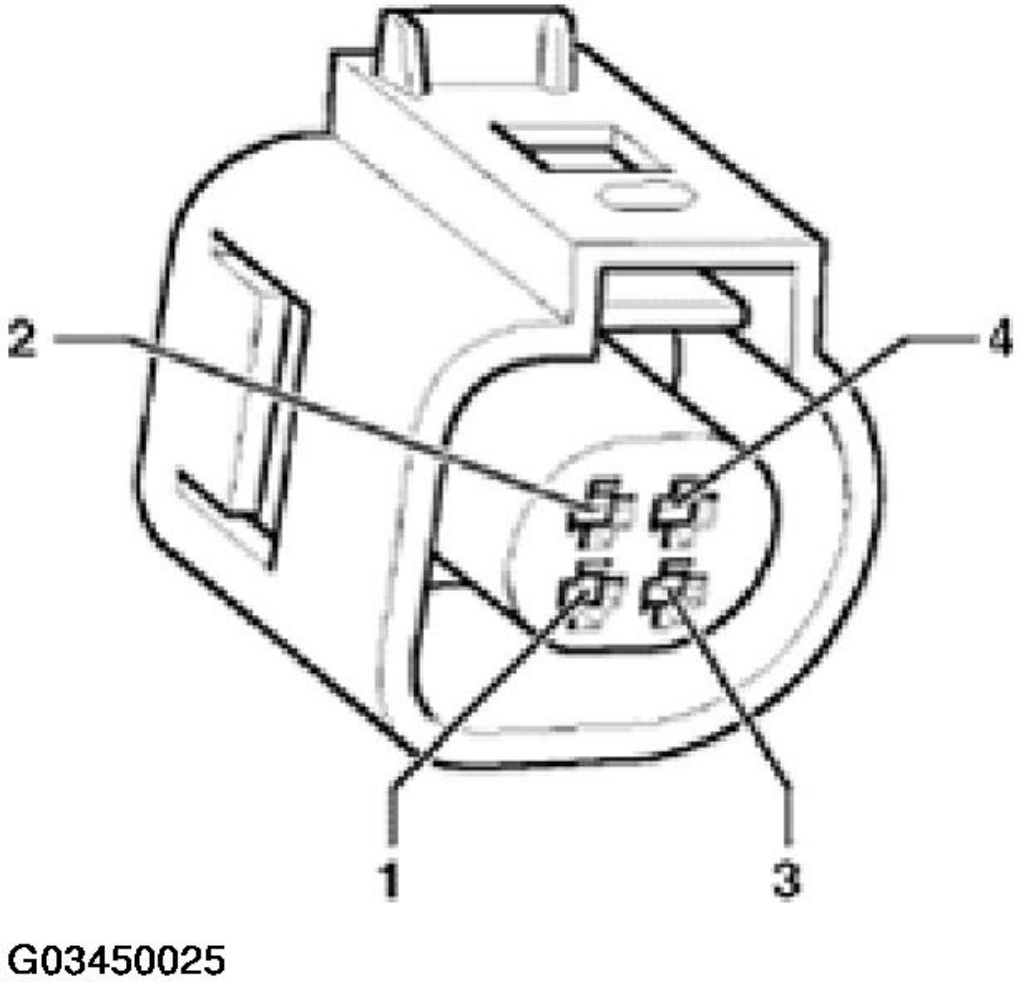


Fig. 50: Identifying ECT Sensor Harness Connector Terminals
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press --> button.
- Press buttons -0- and -6- for "End output" function and confirm input with -Q- button.
- Switch off ignition.

- Replace Engine Coolant Temperature (ECT) sensor -G62- with Engine Coolant Temperature (ECT) sensor -G2 -, see item 28 .
- Check DTC Memory, if necessary, repair any malfunctions and then Erase DTC Memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING** .

- Read readiness code, see **READINESS CODE, DISPLAYING** . If DTC memory has been erased or Motronic Engine Control Module (ECM) -J220- was disconnected from battery positive, readiness code must be generated again, see **READINESS CODE, GENERATING** .

If display remains at approx. -48.0 C:

- Press --> button.
- Press buttons -0- and -6- for "End output" function and confirm input with -Q- button.
- Switch off ignition.
- Check wiring using Electrical Wiring Diagram, see **CHECKING WIRING** .

Continuation of check when display approx. 143.0 °C:

- Disconnect 4-pin connector from Engine Coolant Temperature (ECT) sensor -G62- with Engine Coolant Temperature (ECT) sensor -G2- -arrow-.

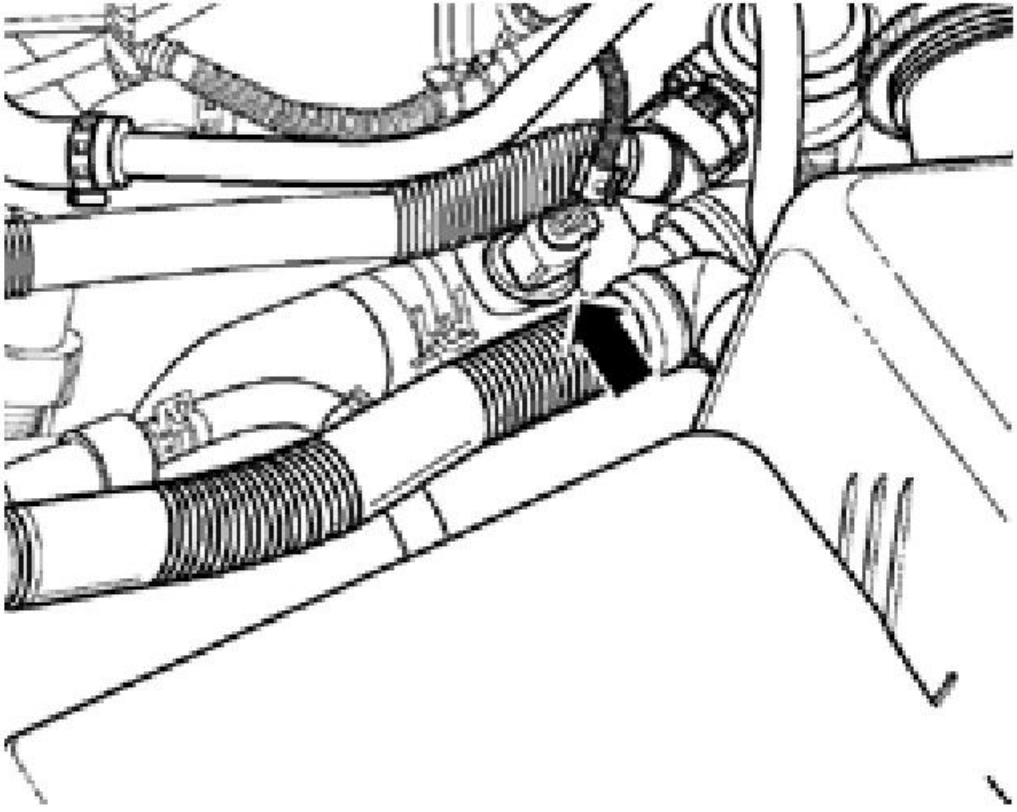


Fig. 51: Disconnecting Pin Connector From Engine Coolant Temperature (ECT) Sensor With Engine Coolant Temperature (ECT) Sensor
Courtesy of VOLKSWAGEN OF AMERICA, INC.

If display jumps to approx. -48.0 C:

- Press -->button.
- Press buttons -0- and -6- for "End output" function and confirm input with -Q- button.
- Switch off ignition.
- Replace Engine Coolant Temperature (ECT) sensor -G62- with Engine Coolant Temperature (ECT) sensor -G2-, see item 28 .
- Check DTC Memory, if necessary, repair any malfunctions and then Erase DTC Memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING** .
- Read readiness code, see **READINESS CODE, DISPLAYING** . If DTC memory has been erased or

Motronic Engine Control Module (ECM) -J220- was disconnected from battery positive, readiness code must be generated again, see **READINESS CODE, GENERATING** .

If display remains at approx. 143.0 °C:

- Press --> button.
- Press buttons -0- and -6- for "End output" function and confirm input with -Q- button.
- Switch off ignition.
- Check wiring using Electrical Wiring Diagram, see **CHECKING WIRING** .

Checking wiring

- Remove inner plenum chamber cover, left:

See **PLENUM CHAMBER INNER COVER, REMOVING AND INSTALLING**

- Connect VAG 1598/31 test box to control module wiring harness. Motronic Engine Control Module (ECM) -J220- is not connected by this action.

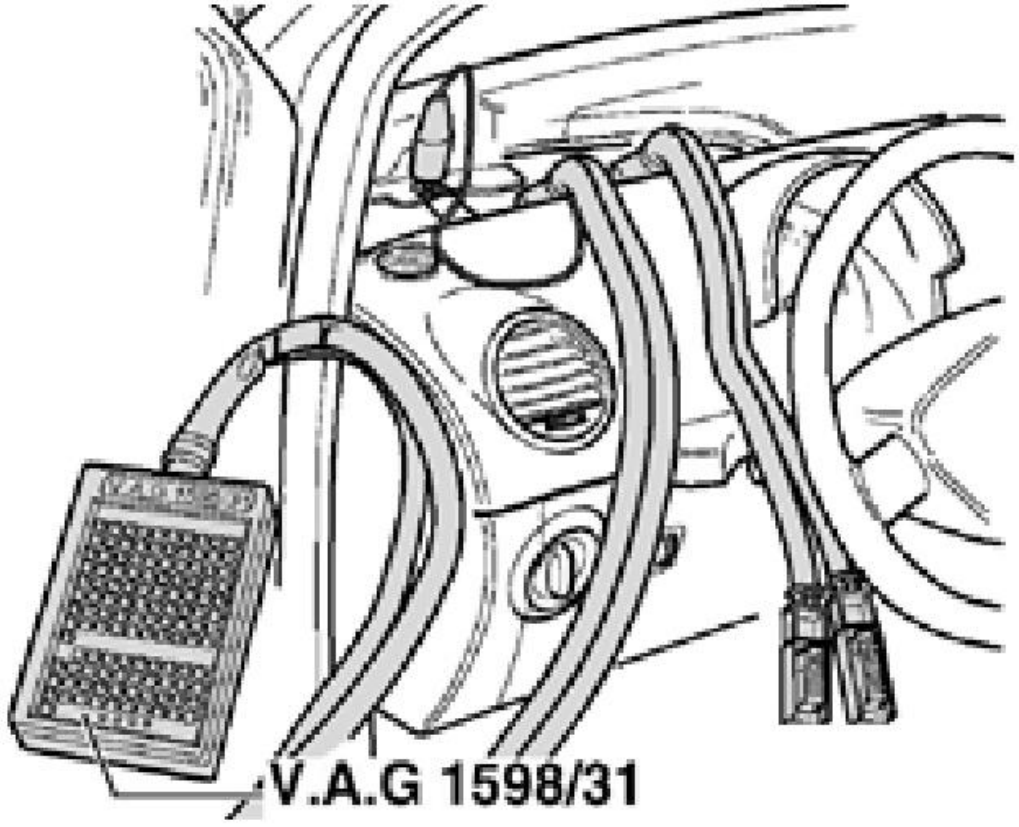
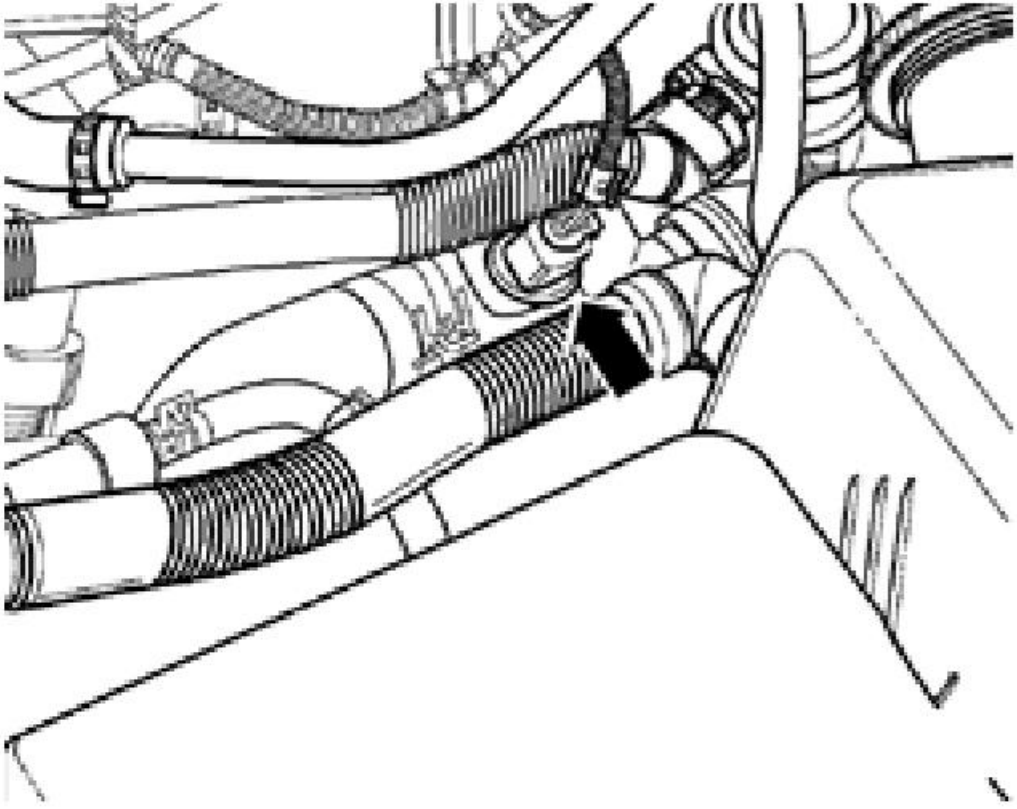


Fig. 52: Connecting VAG 1598/31 Test Box To Control Module Wiring Harness
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Disconnect 4-pin connector from Engine Coolant Temperature (ECT) sensor -G62- with Engine Coolant Temperature (ECT) sensor -G2- -arrow-.



G03450028

Fig. 53: Disconnecting Pin Connector From Engine Coolant Temperature (ECT) Sensor With Engine Coolant Temperature (ECT) Sensor
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check wire for open circuit between test box and 4 -pin connector using Electrical Wiring Diagram.
  - terminal 3 + Socket 93
  - terminal 4 + Socket 108

Wire resistance: max. 1.5

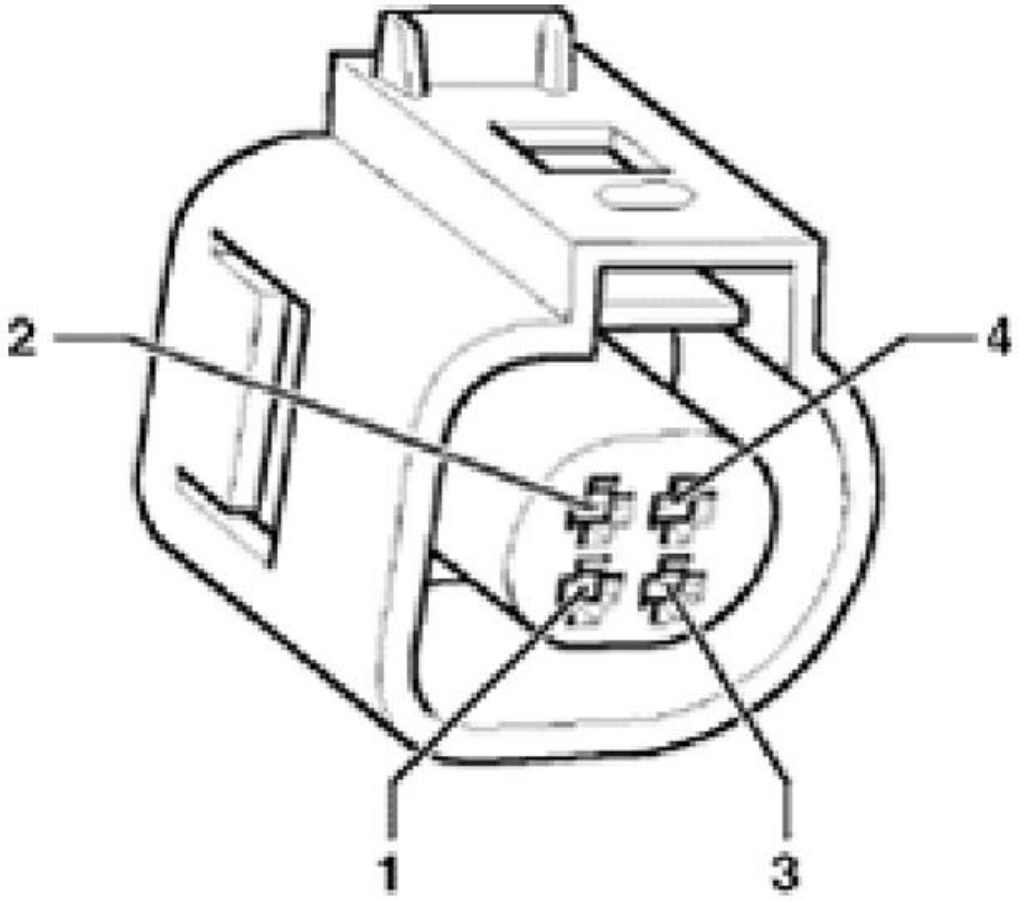


Fig. 54: Identifying ECT Sensor Harness Connector Terminals
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check wiring between test box and 4 -pin connector terminal 3 for short circuit to wire terminal 4 and to vehicle Ground (GND) using Electrical Wiring Diagram.
- terminal 3 + socket 108
- terminal 3 + vehicle Ground (GND)

Specification: INFINITY ohm

- Additionally check both wires for short to battery positive.

Specification:

If no wiring malfunctions are detected:

- Perform resistance measurement on Engine Coolant Temperature (ECT) sensor -G62- terminal C (signal) and D (Ground).

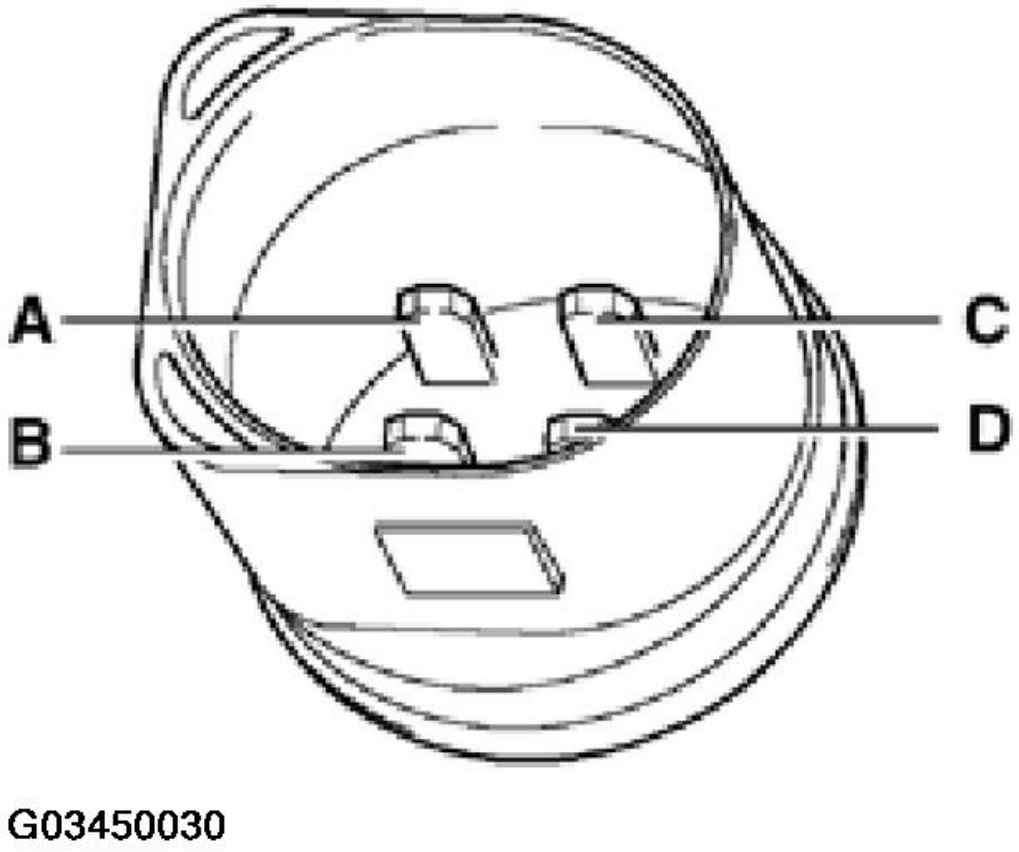


Fig. 55: Identifying ECT Sensor Terminals
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Scale A shows resistance values for temperature range 0 to 50 °C and scale B the values for temperature range 50 to 100 °C.

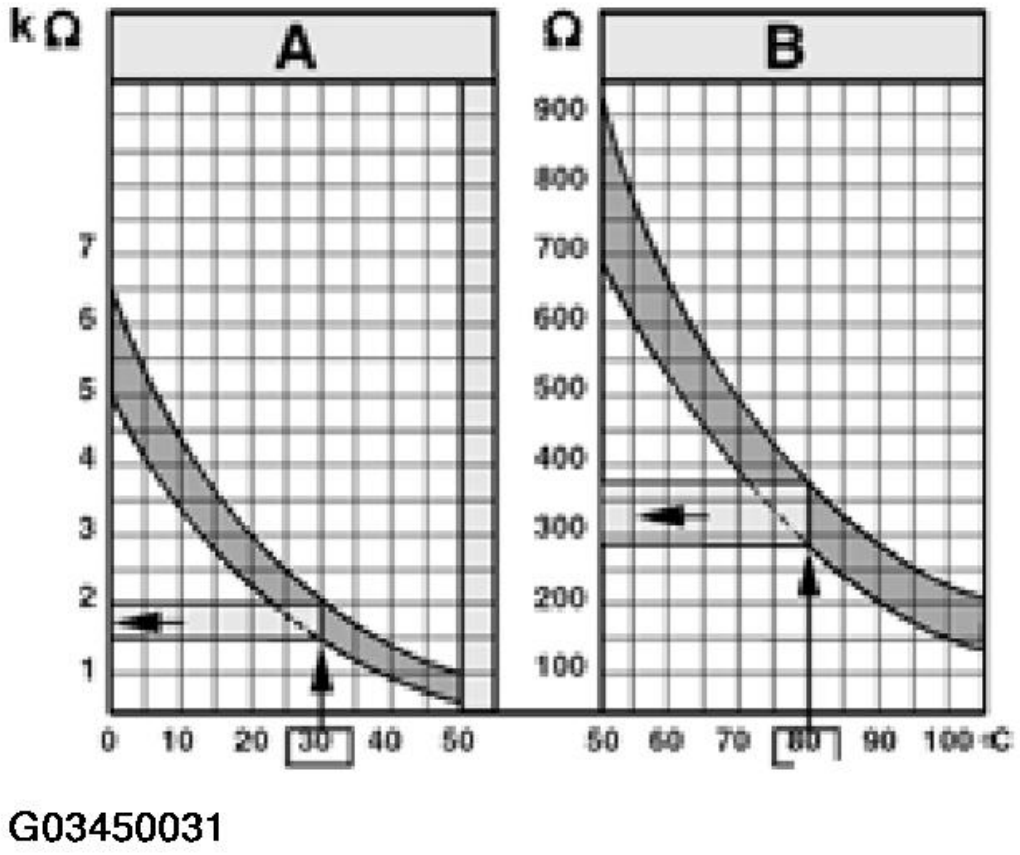


Fig. 56: ECT Sensor Resistance Versus Temperature Range Graph
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Examples:

- 30 °C is in range A and corresponds to a resistance of 1.5 to 2.0 kohm
- 80 °C is in range B and corresponds to a resistance of 275 to 375 ohm

If the specification is not obtained:

- Replace Engine Coolant Temperature (ECT) sensor -G62- with Engine Coolant Temperature (ECT) sensor -G2 -, see item 28 .
- Check DTC Memory, if necessary, repair any malfunctions and then Erase DTC Memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING** .
- Read readiness code, see **READINESS CODE, DISPLAYING** . If DTC memory has been erased or

Motronic Engine Control Module (ECM) -J220- was disconnected from battery positive, readiness code must be generated again, see **READINESS CODE, GENERATING** .

If there is no malfunction in the wiring and the resistance measurement values are OK:

- Replace Motronic Engine Control Module (ECM) -J220-, see **MOTRONIC ENGINE CONTROL MODULE (ECM) - J220-, REPLACING** .

Intake Air Temperature (IAT) sensor, checking

NOTE: Only gold-plated terminals must be used to repair the terminals in the Intake Air Temperature (IAT) sensor.

Special tools, test equipment and auxiliary items

- VAG 1551 scan tool or VAG 1552 mobile scan tool with VAG 1551/3B cable
- VAG 1598/31 test box
- VAG 1526 A or Fluke 83 multimeter
- VAG 1594 adapter set
- Electrical Wiring Diagram
- VAG 1921 pliers for spring type clips
- Chilling spray (commercially available)

Test sequence

- Connect VAG 1551 scan tool ((VAG 1552). Switch ignition on and select Motronic Engine Control Module (ECM) -J220- with "Address word" 01. Connecting scan tool and selecting Motronic Engine Control Module (ECM) -J220-, see **VAG 1551, CONNECTING AND SELECTING MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-** .

Indicated on display

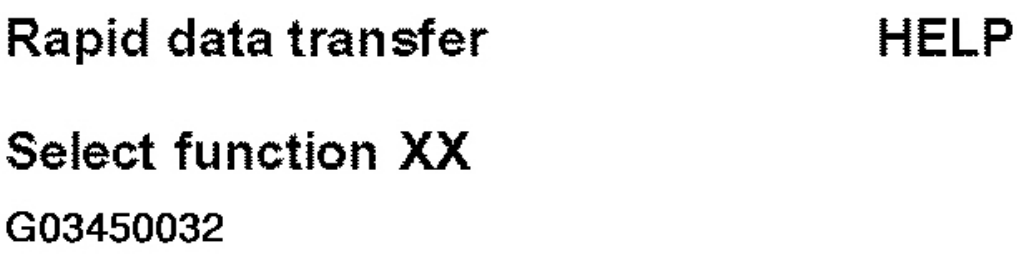


Fig. 57: Identifying Scan Tool Display - Checking IAT Sensor (1 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0- and -8- for function "Read measuring value block" and confirm entry with -Q- button.

  Indicated on display

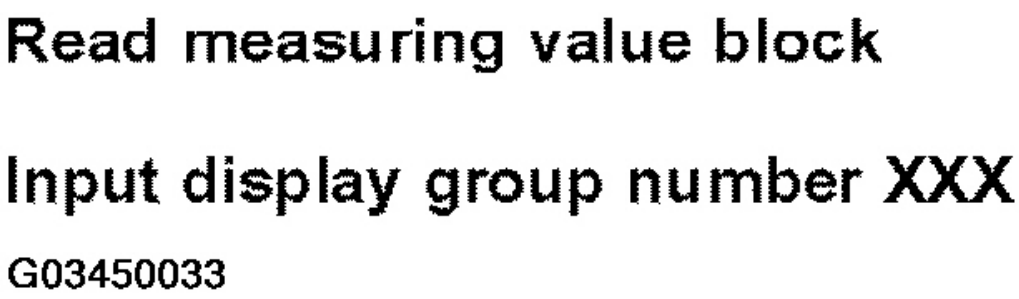


Fig. 58: Identifying Scan Tool Display - Checking IAT Sensor (2 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0-, -0- and -4- for "Display group number 4" and confirm entry with -Q- button.

  Indicated on display (1 to 4 Display zones)

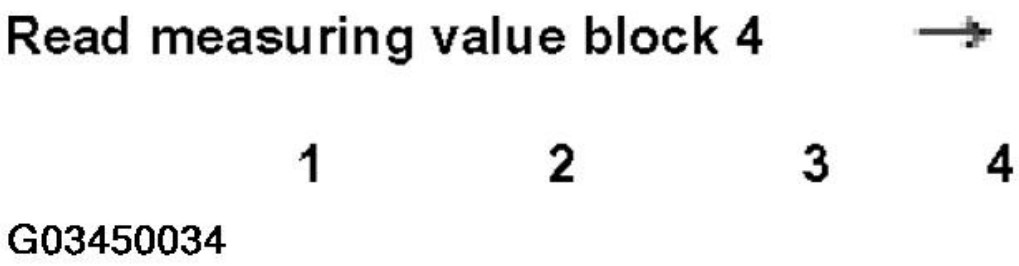


Fig. 59: Identifying Scan Tool Display - Checking IAT Sensor (3 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Read off intake air temperature value in display zone 4.

Specification: approx. ambient temperature

DISPLAY GROUP 4: GENERAL ENGINE DATA

	Display zones			
	1	**2**	**3**	**4**
Display group 4: General engine data				
Display	xxxx RPM	xx.xxx V	xxx.x °C	xxx.x °C
Indicated	Engine speed (in steps of 40)	Supply voltage for Motronic Engine Control Module (ECM) -J220-	Engine Coolant Temperature (ECT)	Intake air temperature
Working range	0 to 6800 RPM	12.000 to 15.000 V	-48.0 to 143.0 °C	-48.0 to 143.0 °C
Specification	760 to 810 RPM(1) 700 to 750 RPM(2)	12.000 to 15.000 V	-	Approx. ambient temperature(3)
	-	-	-	If the specification is not obtained, see **CHECKING WIRING** , Evaluating display group 4

(1) Engine idling at normal operating temperature for manual transmission

(2) Engine idling at normal operating temperature for automatic transmission

(3) If a temperature is displayed which is less than the ambient temperature of the sensor, check sensor wiring for transfer resistances. When doing this be aware that when stationary the sensor can be heated -up by radiated heat.

If the specification is not obtained:

- Perform check according to following table:

Evaluating display group 4, display zone 4 - Intake air temperature

EVALUATING DISPLAY GROUP 4, DISPLAY ZONE 4 - INTAKE AIR TEMPERATURE

Display group: 4 **Display zone: 4**	**Possible cause**	**Corrective action**
Approx. -48.0 °C(1)	• Wiring open circuit or short to positive	• Continuation, see **CHECKING WIRING**
Approx. 143.0 °C(1)	• Short to Ground (GND)	• Continuation, see **CHECKING WIRING**
Approx. ambient temperature	• Signal periodically interrupted	• Check sensor, see **CHECKING WIRING** , continuation for ambient temperature

(1) If a temperature is displayed which is below the ambient air temperature of the sensor, check sensor wiring for transfer resistances. Note when doing this that sensor is heated from external sources, e.g. radiated heat when engine is not running.

If the specification is obtained:

Continuation of check when display = ambient temperature:

- Disconnect 2-pin connector -arrow- from Intake Air Temperature (IAT) sensor -G42-.

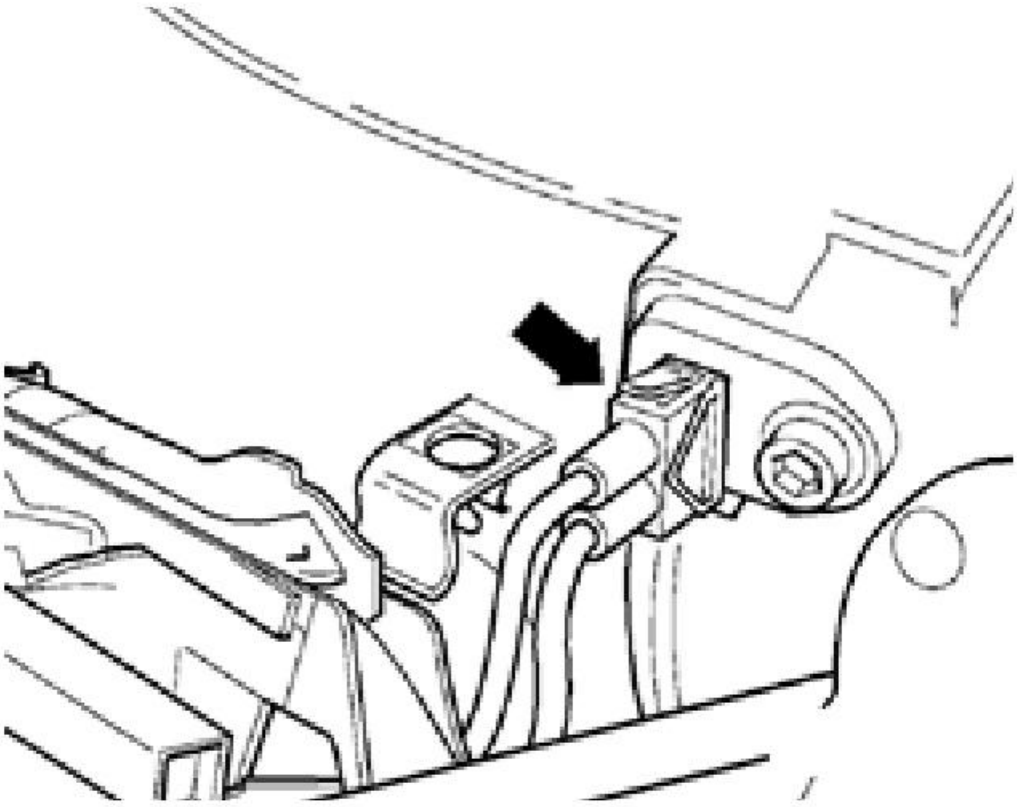


Fig. 60: Disconnecting Pin Connector From Intake Air Temperature (IAT) Sensor
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Remove Intake Air Temperature (IAT) sensor -arrow-.

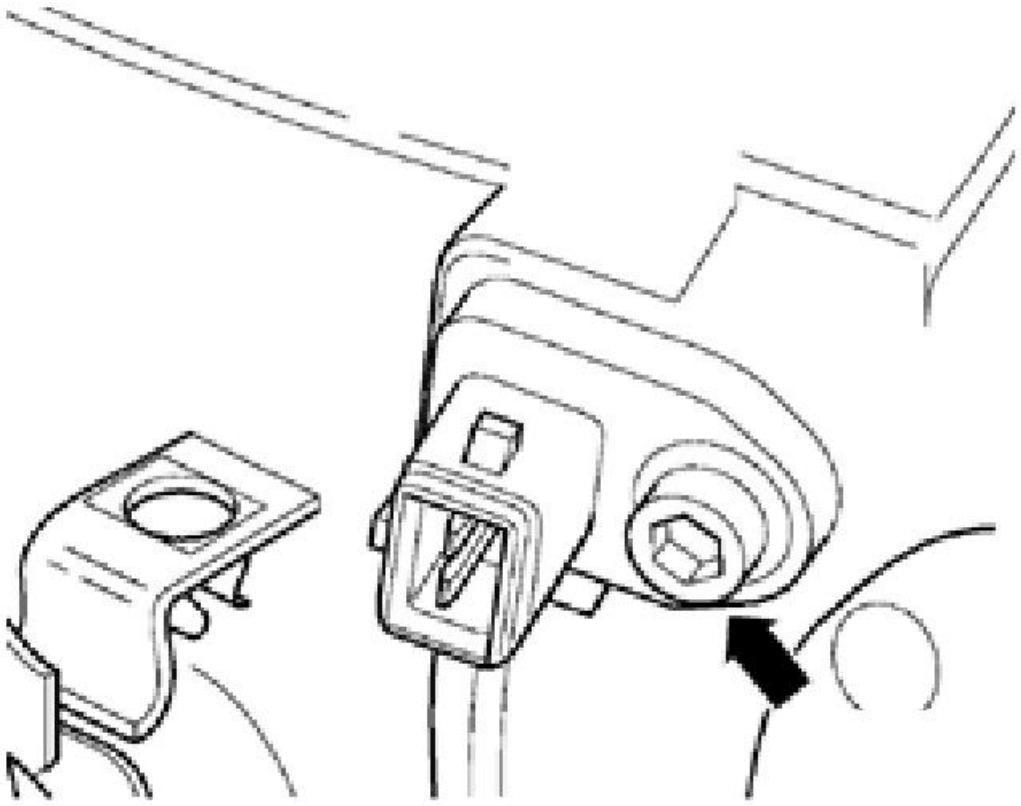
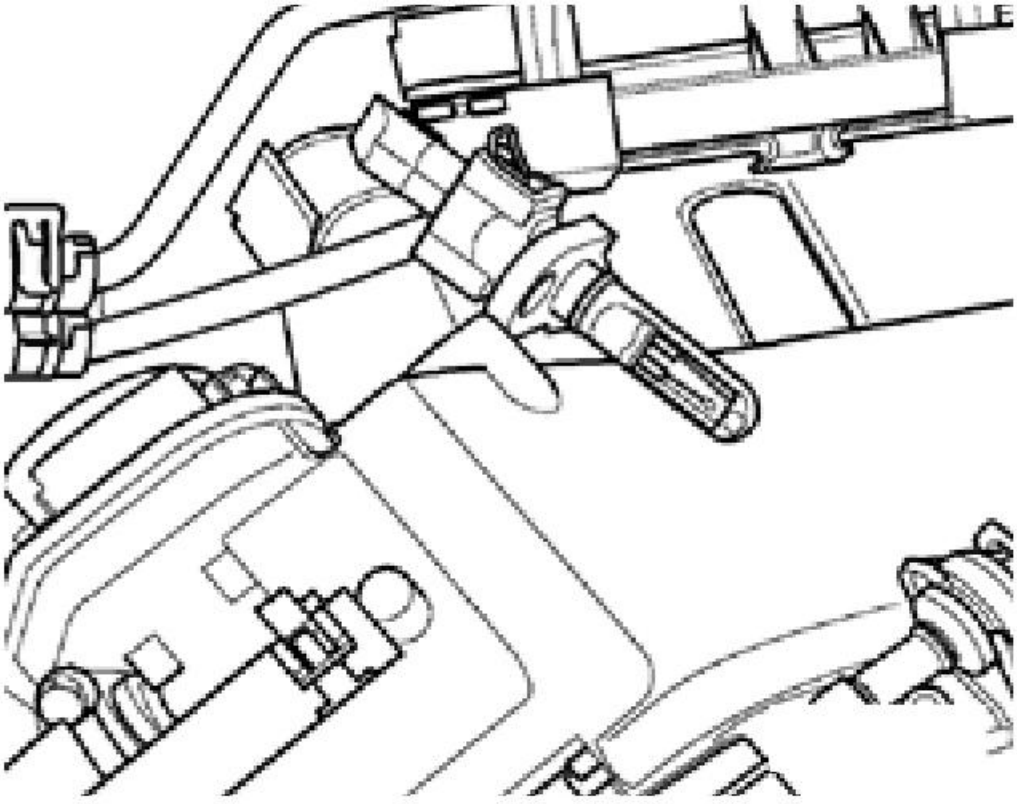


Fig. 61: Removing Intake Air Temperature (IAT) Sensor
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Re-connect 2-pin connector.
- Note intake air temperature value in display zone 4.
- Spray sensor -arrow- with commercial chilling agent while observing temperature value.



G03450037

Fig. 62: Spray Sensor With Commercial Chilling Agent While Observing Temperature Value
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Temperature value must decrease.

If the specification is not obtained:

- Press --> button.
- Press buttons -0- and -6- for function "End output" and confirm entry with -Q- button.
- Switch off ignition.

Continuation of check when display reads approx. -48.0 °C:

- Disconnect connector -1- from Intake Air Temperature (IAT) sensor -G42- -2-.

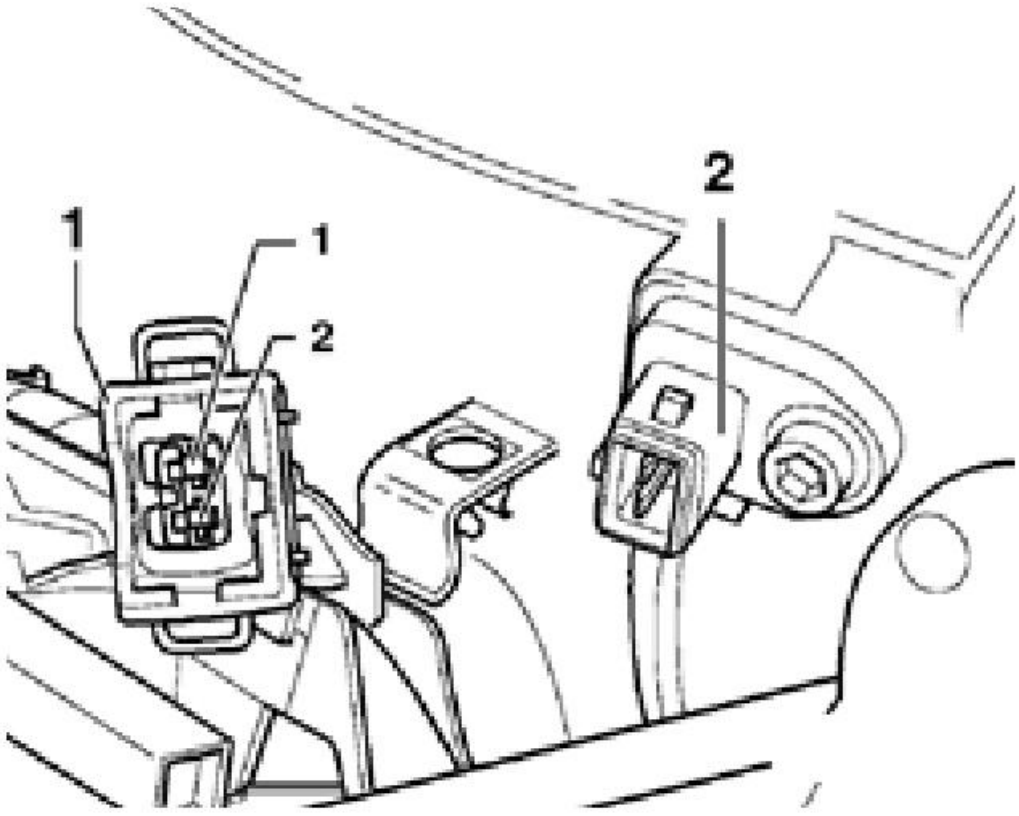


Fig. 63: Disconnecting Connector From Intake Air Temperature (IAT) Sensor
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Bridge connector terminals using aux. cables from VAG 1594 and observe display.

  If display jumps to approx. 143.0 °C:

- Press --> button.
- Press buttons -0- and -6- for function "End output" and confirm entry with -Q- button.
- Switch off ignition.
- Replace Intake Air Temperature (IAT) sensor -G42-, see item 26 .
- Check DTC Memory, if necessary, repair any malfunctions and then Erase DTC Memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING** .

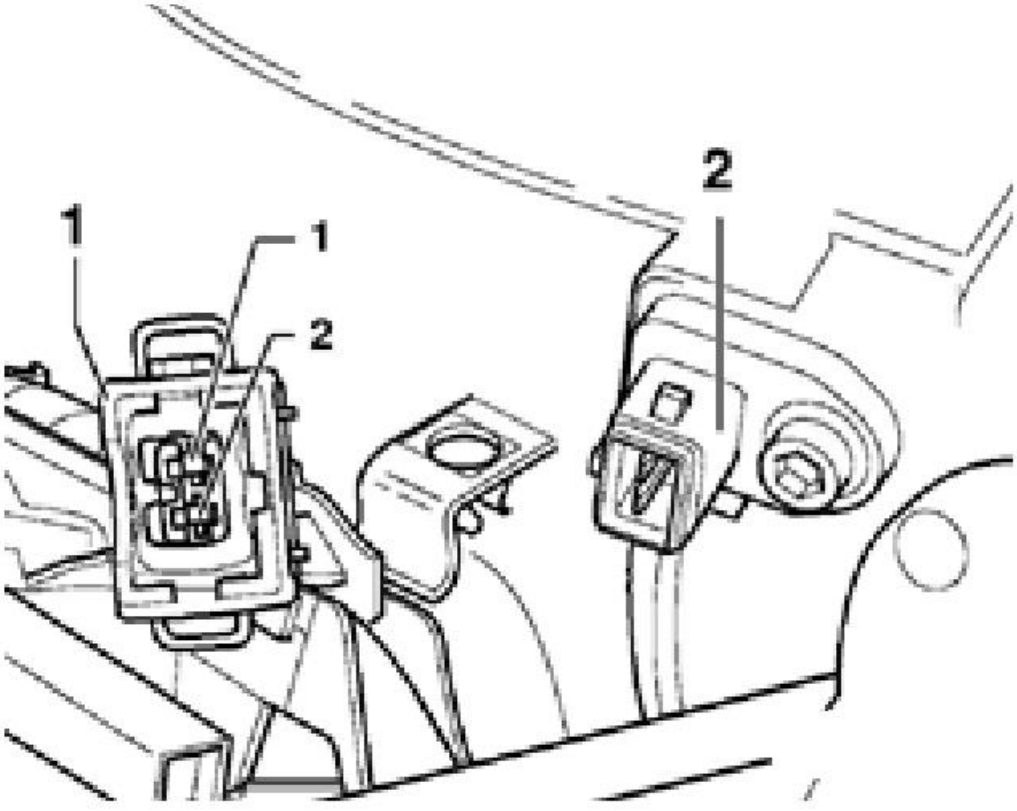
- Read readiness code, see **READINESS CODE, DISPLAYING** . If DTC memory has been erased or Motronic Engine Control Module (ECM) -J220- was disconnected from battery positive, readiness code must be generated again, see **READINESS CODE, GENERATING** .

If display remains at approx. -48.0 °C:

- Press --> button.
- Press buttons 0 and 6 for function "End output" and confirm entry with Q button.
- Switch off ignition.
- Check wiring using Electrical Wiring Diagram, see **CHECKING WIRING** .

Continuation of check when display reads approx. 143 °C:

- Disconnect connector -1- from Intake Air Temperature (IAT) sensor -2-.



G03450039

Fig. 64: Disconnecting Connector From Intake Air Temperature (IAT) Sensor
Courtesy of VOLKSWAGEN OF AMERICA, INC.

If display jumps to approx. -48.0 °C:

- Press --> button.
- Press buttons -0- and -6- for function "End output" and confirm entry with -Q- button.
- Switch off ignition.
- Replace Intake Air Temperature (IAT) sensor -G42-, see item 26 .

- Check DTC Memory, if necessary, repair any malfunctions and then Erase DTC Memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING** .
- Read readiness code, see **READINESS CODE, DISPLAYING** . If DTC memory has been erased or Motronic Engine Control Module (ECM) -J220- was disconnected from battery positive, readiness code must be generated again, see **READINESS CODE, GENERATING** .

If display remains at approx. 143 °C:

- Press --> button.
- Press buttons -0- and -6- for function "End output" and confirm entry with -Q- button.
- Switch off ignition.
- Check wiring using Electrical Wiring Diagram, see **CHECKING WIRING** .

Checking wiring

- Remove inner plenum chamber cover, left:

  See **PLENUM CHAMBER INNER COVER, REMOVING AND INSTALLING**

- Connect VAG 1598/31 test box to control module wiring harness. Motronic Engine Control Module (ECM) -J220- is not connected by this action.

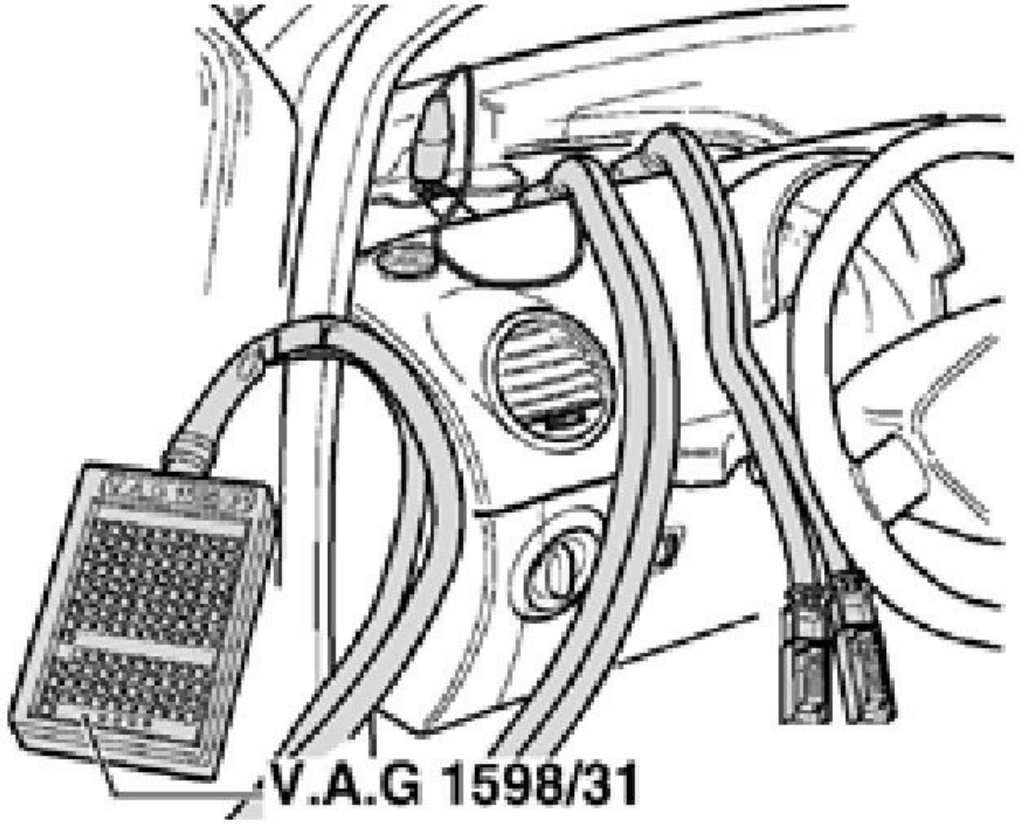


Fig. 65: Connecting VAG 1598/31 Test Box To Control Module Wiring Harness
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Disconnect connector -1- from Intake Air Temperature (IAT) sensor -2-.

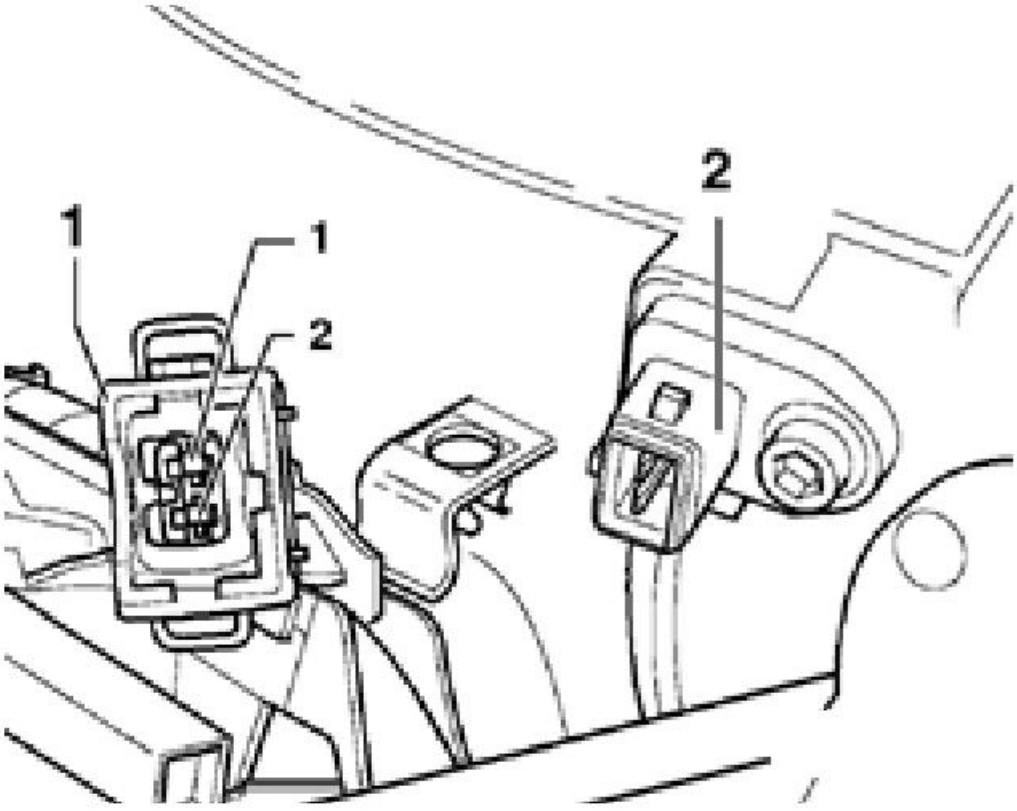


Fig. 66: Disconnecting Connector From Intake Air Temperature (IAT) Sensor
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check wiring between test box and 2 -pin connector -1- for open circuit according to Electrical Wiring Diagram.
  - Terminal 1 + Socket 85
  - Terminal 2 + Socket 108

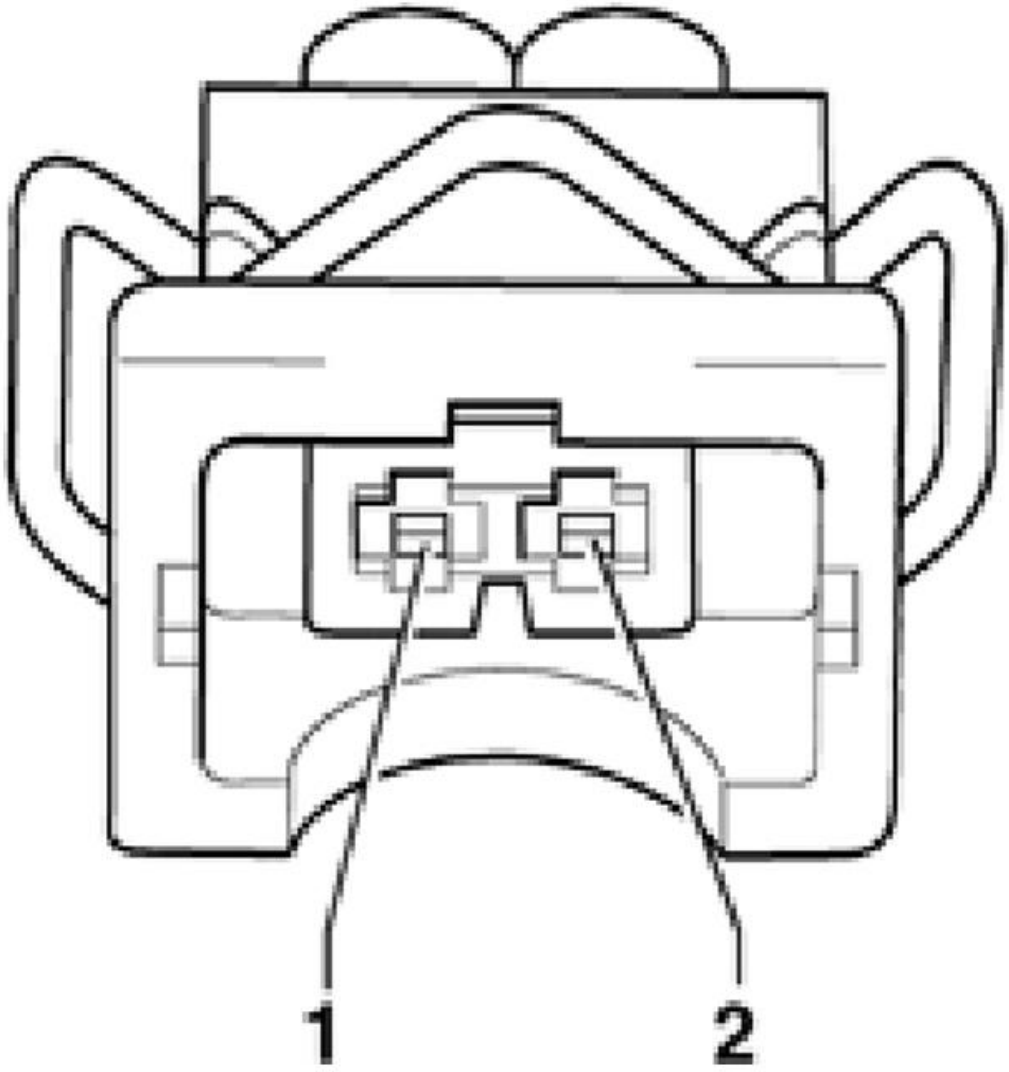


Fig. 67: Identifying IAT Sensor Harness Connector Terminals
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Wire resistance: max. 1.5

- Additionally check both wires for short to battery positive.

Specification: INFINITY ohm

If no wiring malfunctions are detected:

- Perform resistance measurement on Intake Air Temperature (IAT) sensor -G42- terminals 1 (signal) and 2 (ground).

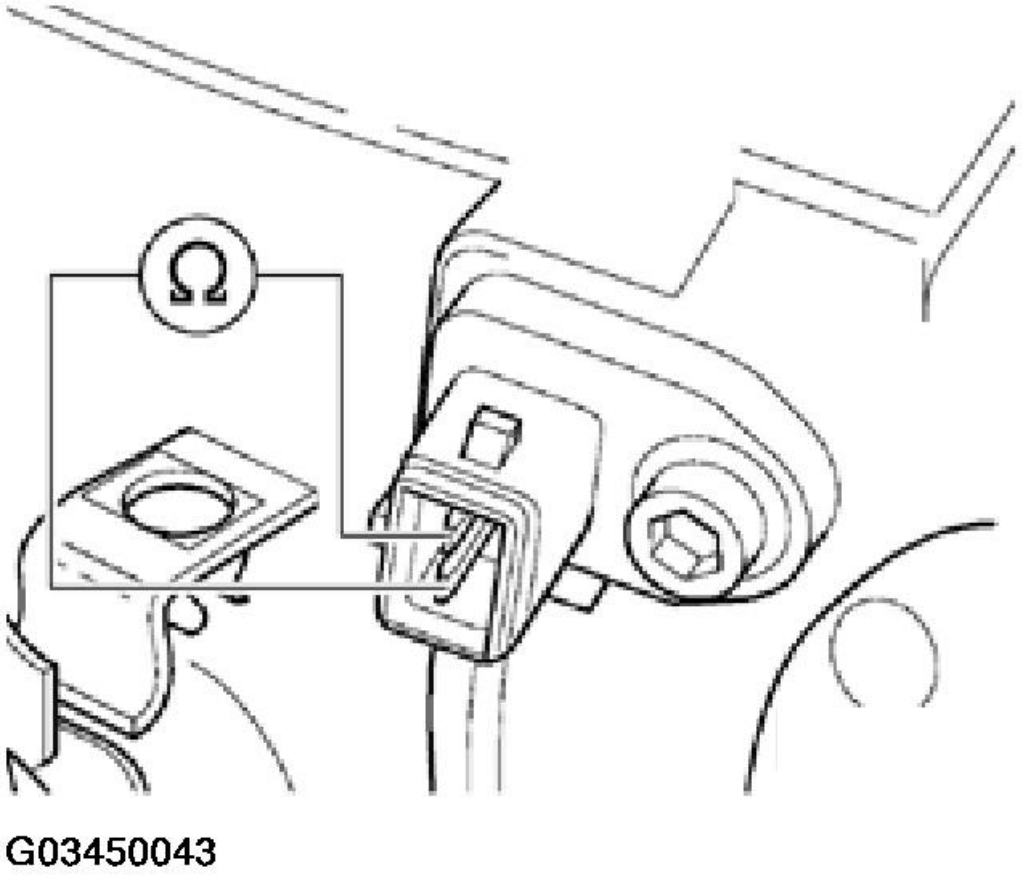


Fig. 68: Performing Resistance Measurement On Intake Air Temperature (IAT) Sensor Terminal1 (Signal)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Scale A shows resistance values for temperature range 0 to 50 °C and scale B the values for temperature range 50 to 100 °C.

Examples:

- 30 °C is in range A and corresponds to a resistance of 1.5 to 2.0 kohm
- 80 °C is in range B and corresponds to a resistance of 275 to 375 ohm

If the specification is not obtained:

- Replace Intake Air Temperature (IAT) sensor -G42-, see item 26 .
- Check DTC Memory, if necessary, repair any malfunctions and then Erase DTC Memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING** .
- Read readiness code, see **READINESS CODE, DISPLAYING** . If DTC memory has been erased or Motronic Engine Control Module (ECM) -J220- was disconnected from battery positive, readiness code must be generated again, see **READINESS CODE, GENERATING** .

If there is no malfunction in the wiring and the resistance measurement values are OK:

- Replace Motronic Engine Control Module (ECM) -J220-, see **MOTRONIC ENGINE CONTROL MODULE (ECM) - J220-, REPLACING** .

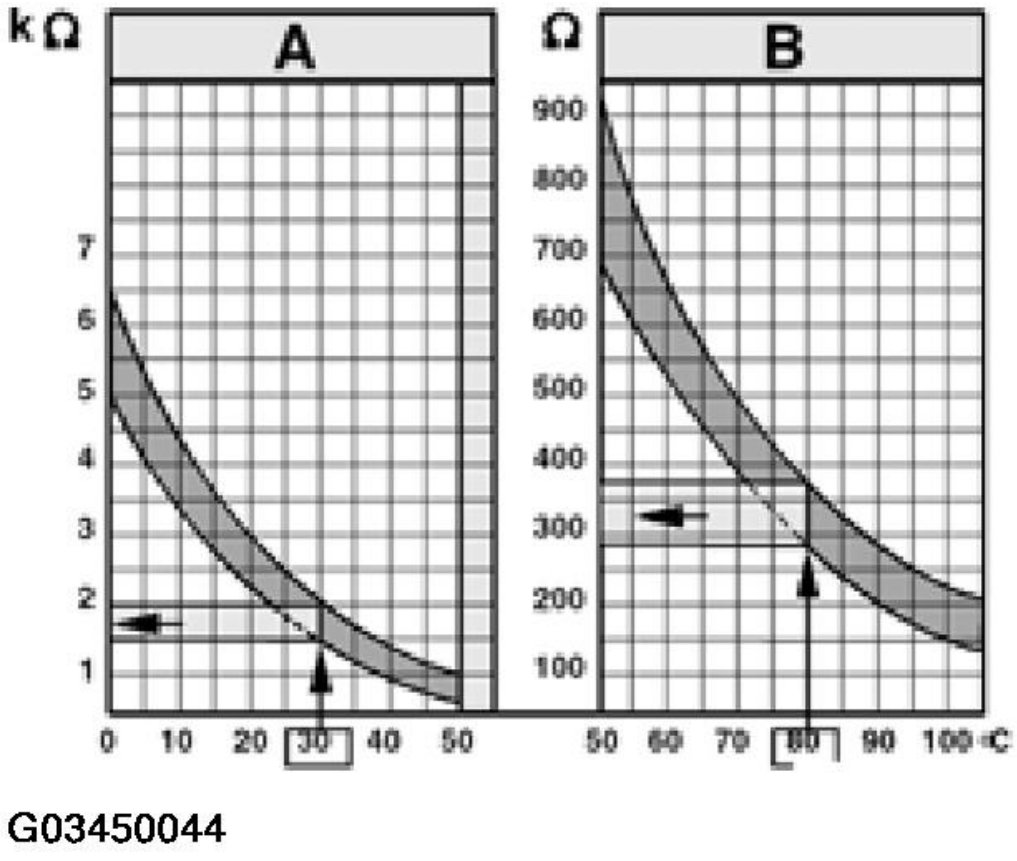


Fig. 69: IAT Sensor Resistance Versus Temperature Range Graph

Courtesy of VOLKSWAGEN OF AMERICA, INC.

Engine speed (RPM) sensor, checking

The Engine Speed (RPM) Sensor -G28- is a speed and reference mark sensor. The engine will not start if there is no speed signal. If the speed signal fails when the engine is running, it will cause the engine to stall immediately.

Special tools, test equipment and auxiliary items

- VAG 1551 scan tool or VAG 1552 mobile scan tool with VAG 1551/3B cable
- VAG 1598/31 test box
- VAG 1526 A or Fluke 83 multimeter
- VAG 1594 adapter set
- Electrical Wiring Diagram

Test sequence

- Separate gray 3 -pin connector -1- to Engine Speed (RPM) Sensor -G28-.

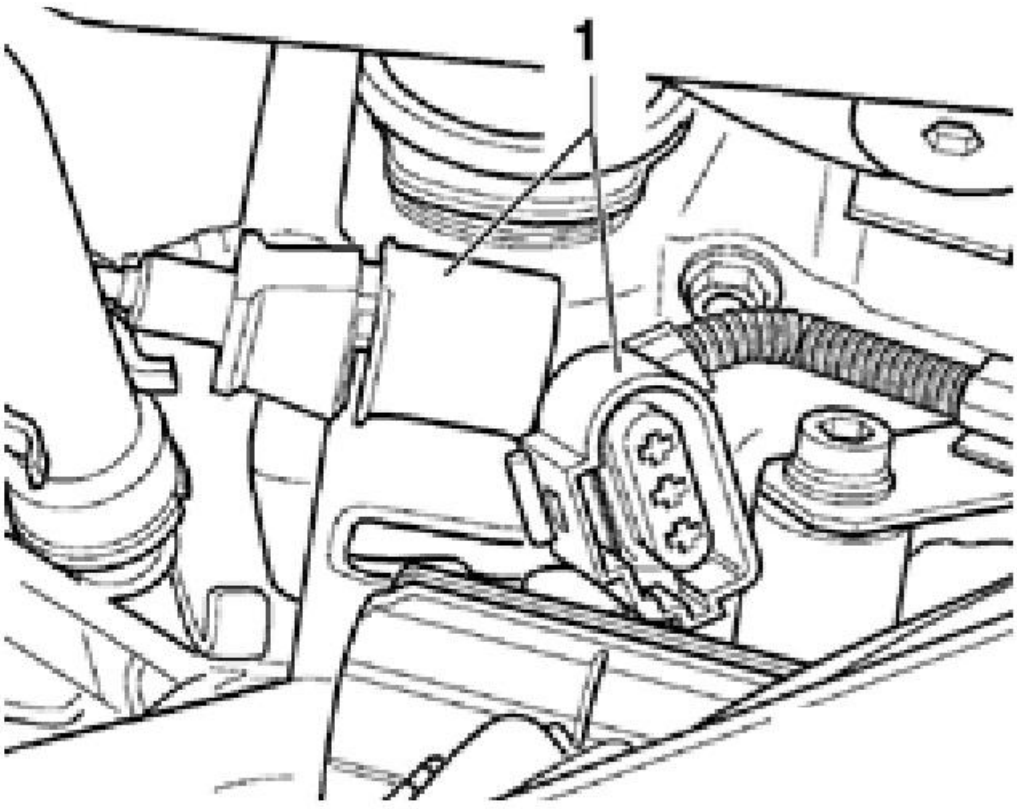


Fig. 70: Separating Pin Connector To Engine Speed (RPM) Sensor
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Measure sensor resistance between terminals 2 + 3 of connector to sensor.

  Specification: 730 to 1000 ohm

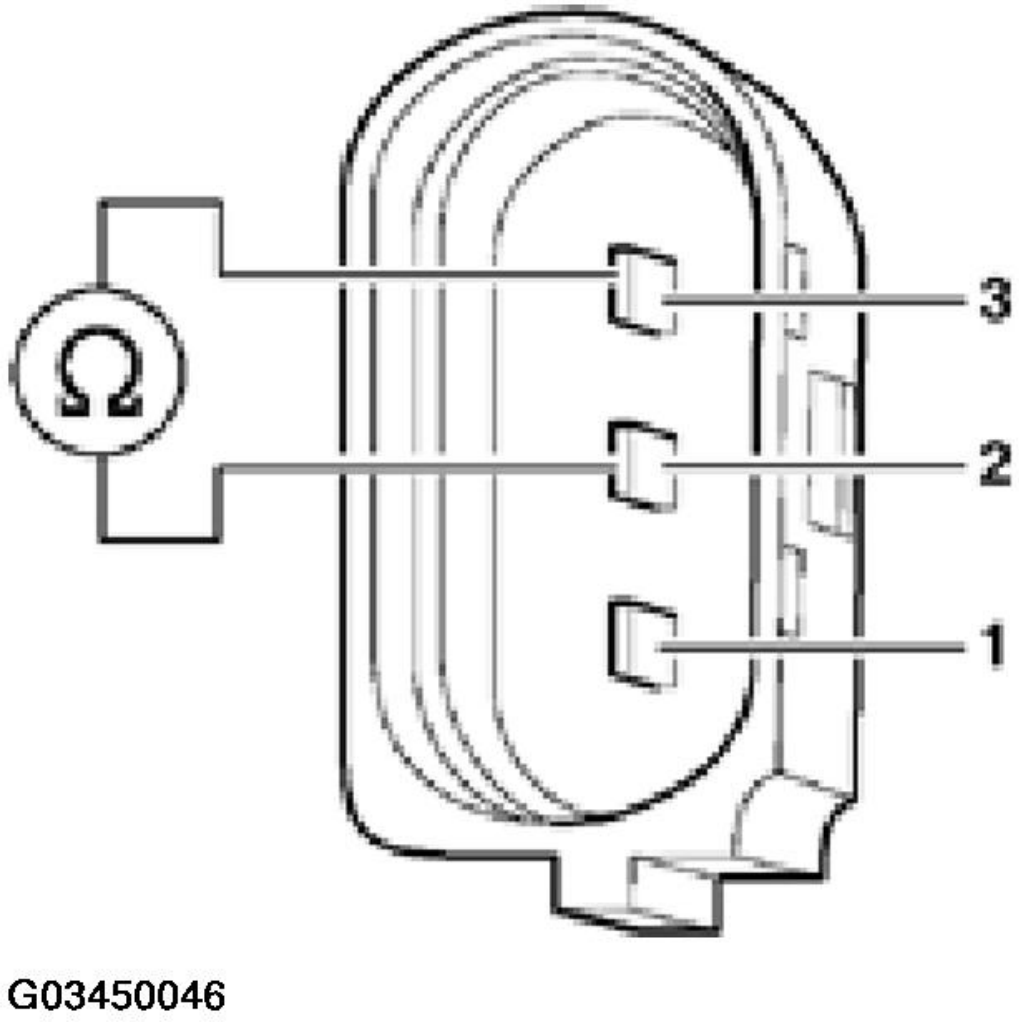


Fig. 71: Measuring Sensor Resistance Between Terminals Of Connector To Engine Speed (RPM) Sensor
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check sensor for short between terminals 1 + 2 as well as 1 + 3.

Specification: INFINITY ohm

If the specifications are not obtained:

- Replace Engine Speed (RPM) Sensor -G28-, see item 13 .
- Check DTC Memory, if necessary, repair any malfunctions and then Erase DTC Memory, see **DTC**

MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING .

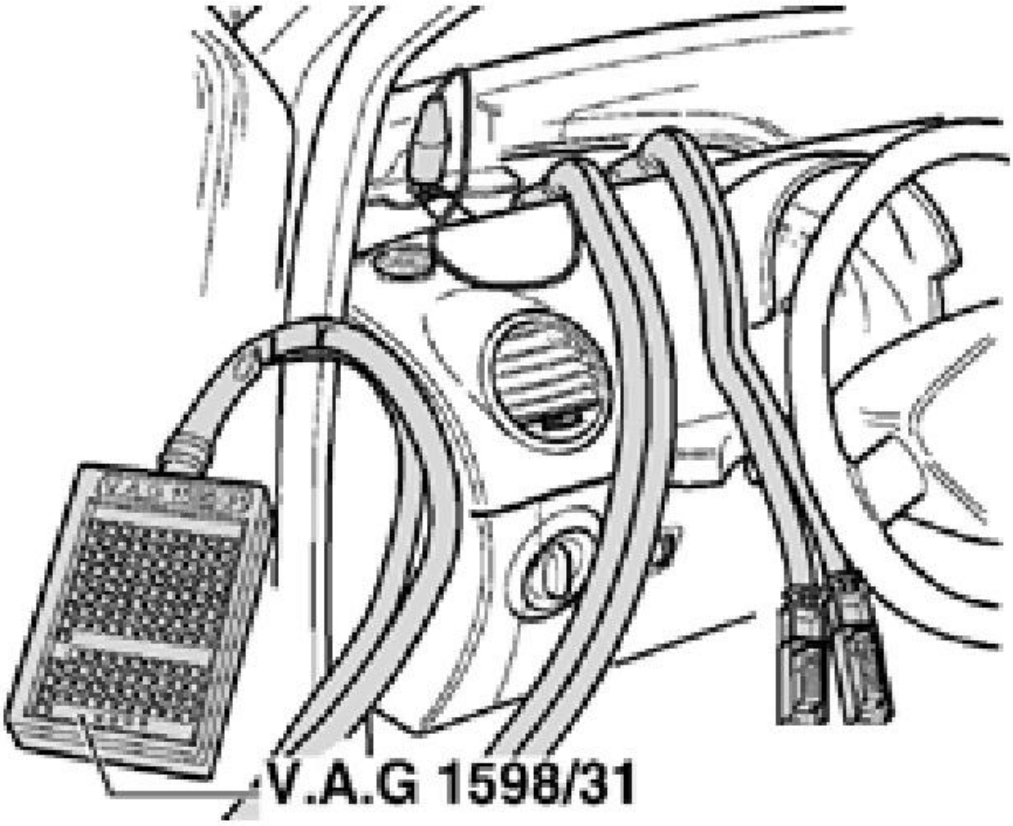
- Read readiness code, see **READINESS CODE, DISPLAYING** . If DTC memory has been erased or Motronic Engine Control Module (ECM) -J220- was disconnected from battery positive, readiness code must be generated again, see **READINESS CODE, GENERATING** .

If no sensor malfunction is detected:

- Remove inner plenum chamber cover, left:

See **PLENUM CHAMBER INNER COVER, REMOVING AND INSTALLING**

- Connect VAG 1598/31 test box to control module wiring harness. Motronic Engine Control Module (ECM) -J220- is not connected by this action.



G03450047

Fig. 72: Connecting VAG 1598/31 Test Box To Control Module Wiring Harness
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check wiring for open circuit between test box and 3 -pin connector using Electrical Wiring Diagram.
  - terminal 1 + socket 108
  - terminal 2 + socket 90
  - terminal 3 + socket 82

  Wire resistance: Max. 1.5

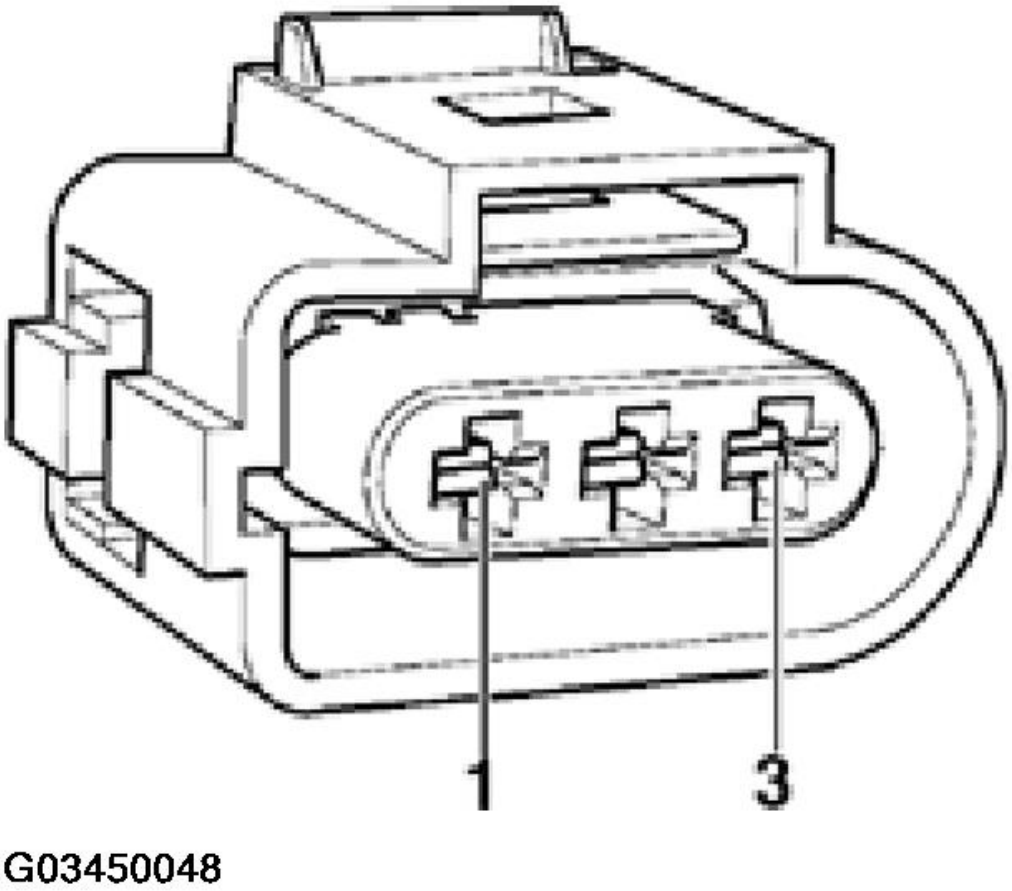


Fig. 73: Identifying Engine Speed (RPM) Sensor Harness Connector Terminals
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Additionally check wires for short to one another.

If no wiring malfunction is found:

- Remove sensor and check sensor wheel for secure fit, damage and run -out.

NOTE: There is a larger gap on the sensor wheel. This gap is the reference mark and does not mean that the sensor wheel is damaged.

If no malfunction is detected on sensor wheel:

- Replace Motronic Engine Control Module (ECM) -J220-, see **MOTRONIC ENGINE CONTROL MODULE (ECM) - J220-, REPLACING** .

Fuel injectors, checking

Special tools, test equipment and auxiliary items

- VAG 1551 scan tool or VAG 1552 mobile scan tool with VAG 1551/3B cable
- VAG 1598/31 test box
- VAG 1526 A or Fluke 83 multimeter
- VAG 1527 voltage tester
- VAG 1594 adapter set
- Electrical Wiring Diagram

Test conditions

- All fuses must be OK. Fuse holder is located behind access panel at far left end of dash.

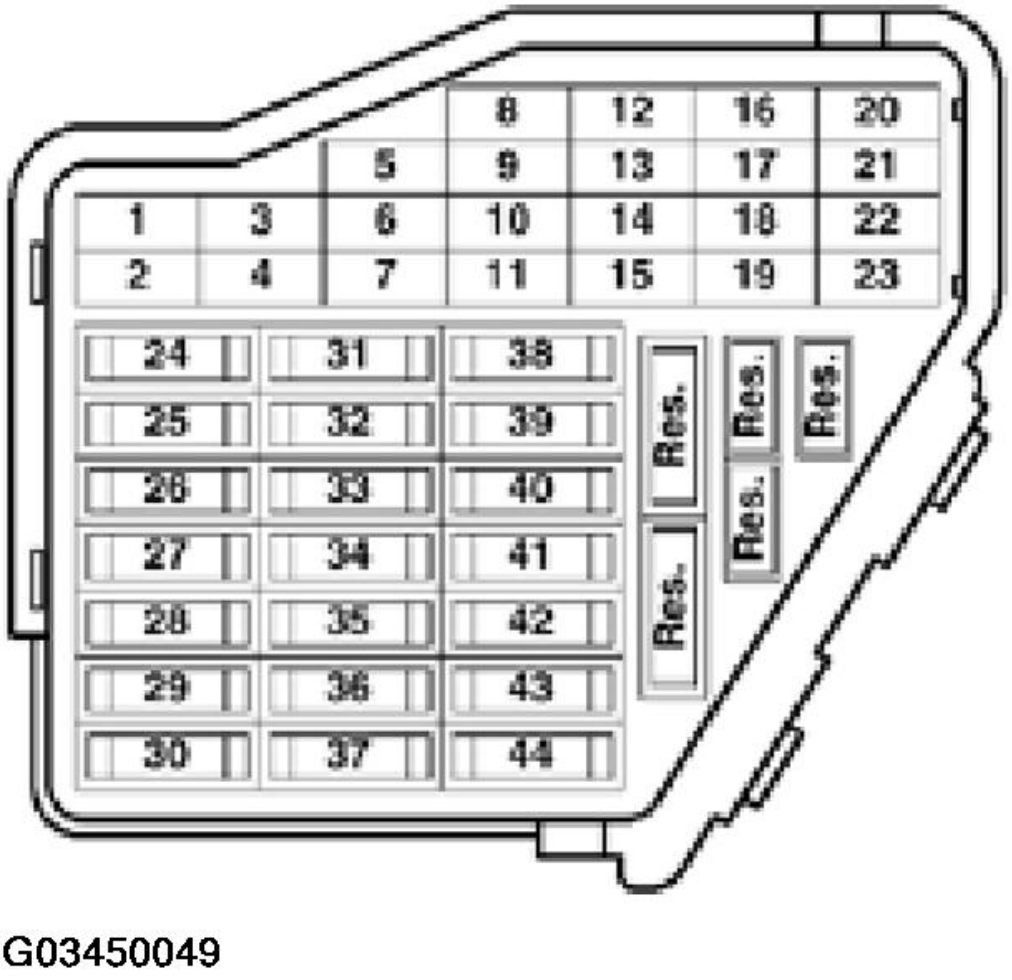


Fig. 74: Locating Fuses
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Engine Speed (RPM) Sensor -G28- must be OK, checking, see **ENGINE SPEED (RPM) SENSOR, CHECKING**
- Battery voltage must be at least 11.5 V
- Fuel pump relay must be OK

Test sequence

Checking resistance of fuel injectors

- Disconnect connectors from fuel injectors.

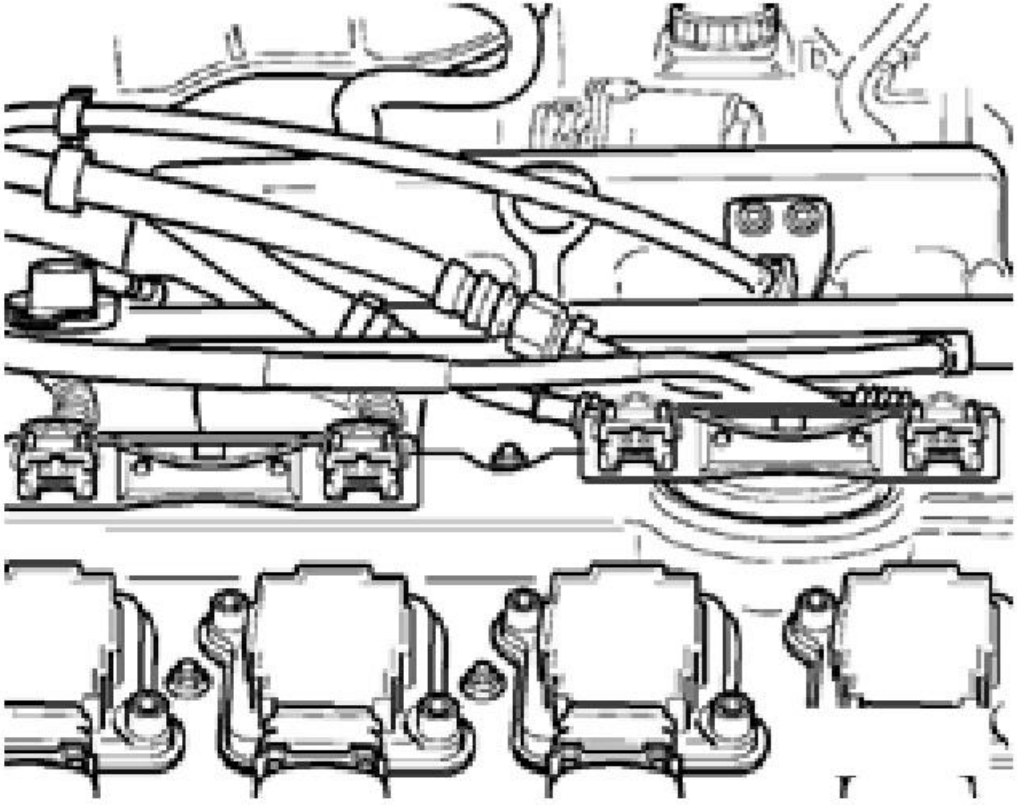


Fig. 75: Disconnecting Connectors From Fuel Injectors
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check resistance of fuel injectors between terminals.

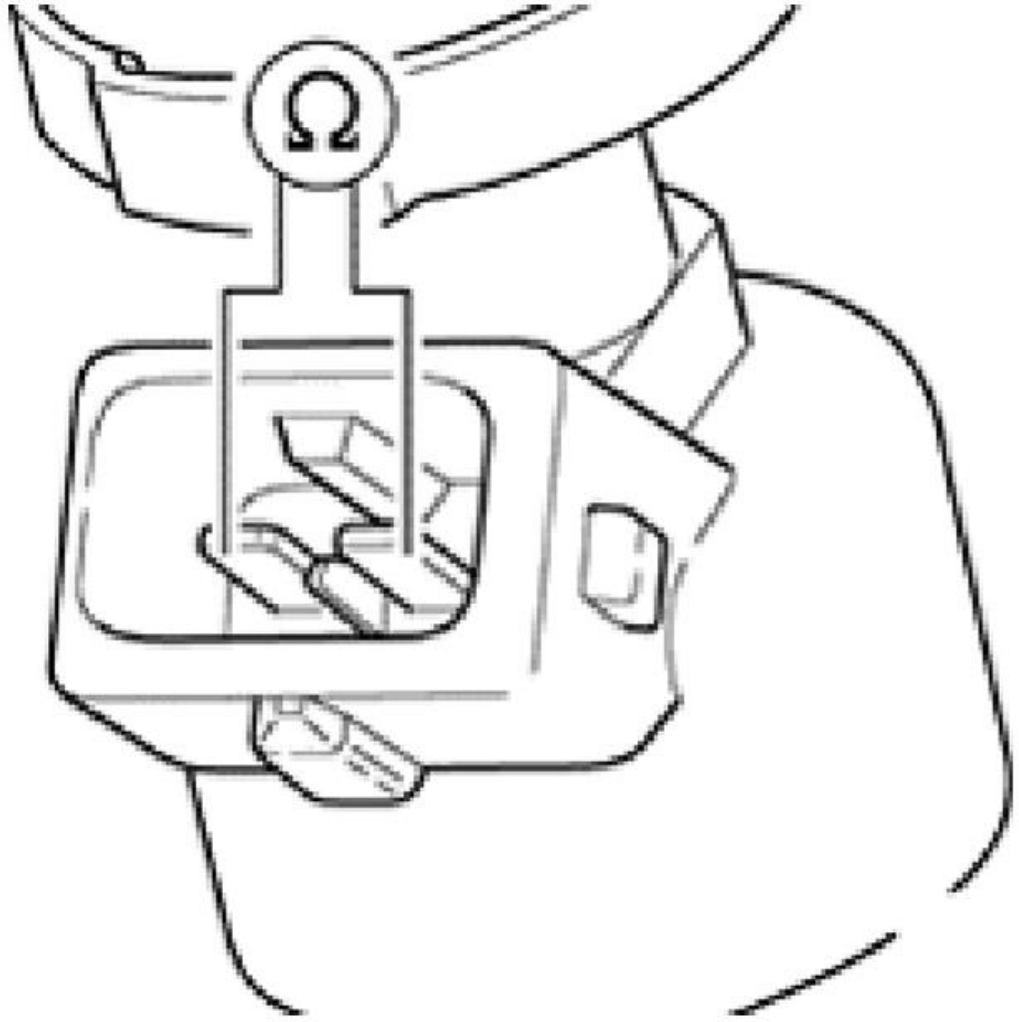


Fig. 76: Checking Resistance Of Fuel Injectors Between Terminals
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Specification: 12.0 to 17.0

NOTE: The resistance figures are valid for approx. 20°C. At higher temperature the resistance figures will increase.

If the specification is not obtained:

- Replace malfunctioning fuel injector, see item 10 .

Pay attention to the following when installing the fuel injector:

- Replace O -rings on all fuel injectors and lightly moisten with clean engine oil.
- Insert fuel injectors vertically and in the correct position into the fuel rail and secure with retaining clips.
- Install fuel rail with secured fuel injectors onto intake manifold and press in evenly.

- Check DTC Memory, if necessary, repair any malfunctions and then Erase DTC Memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING** .
- Read readiness code, see **READINESS CODE, DISPLAYING** . If DTC memory has been erased or Motronic Engine Control Module (ECM) -J220- was disconnected from battery positive, readiness code must be generated again, see **READINESS CODE, GENERATING** .

Checking voltage supply

- Disconnect connectors from fuel injectors.

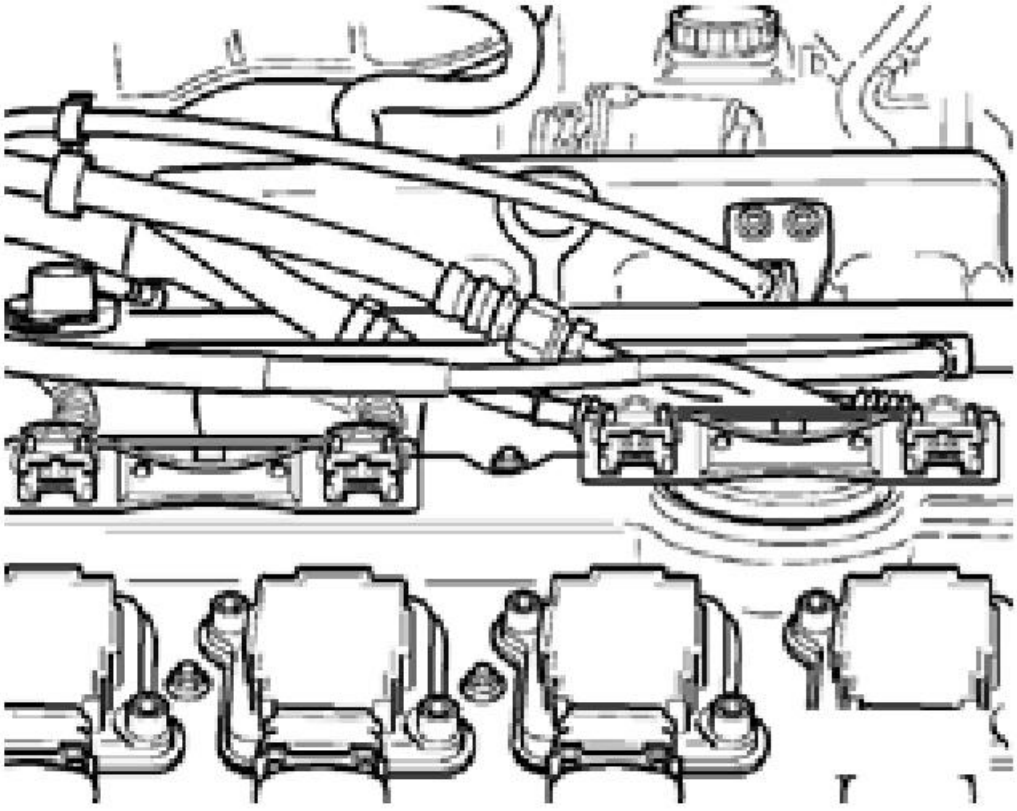


Fig. 77: Disconnecting Connectors From Fuel Injectors
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Connect LED test light to terminal 1 and Ground (GND) of relevant fuel injector connector.

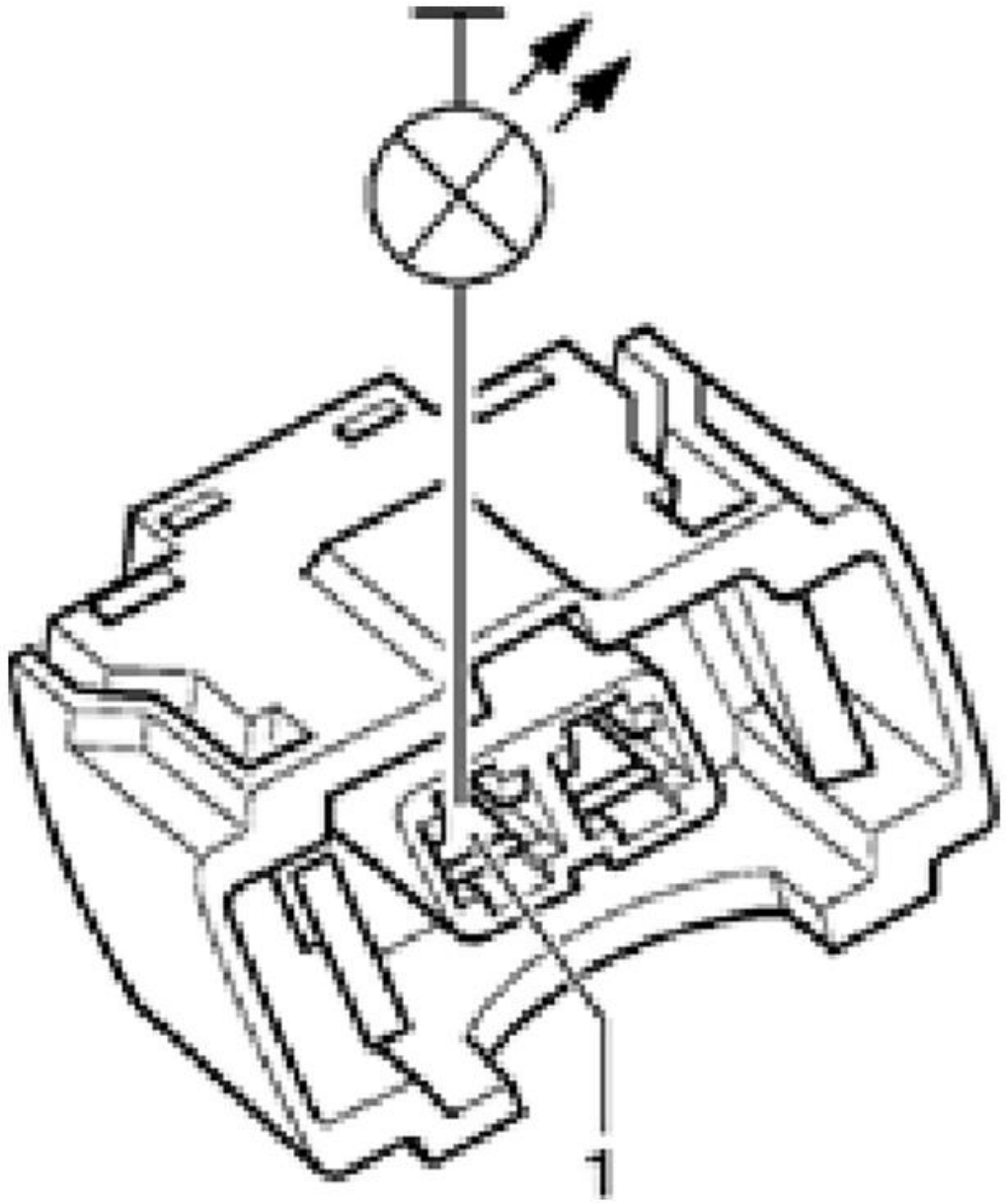


Fig. 78: Connecting LED Test Light To Terminal 1 And Ground Of Fuel Injector Harness Connector
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Operate starter and check voltage supply for fuel injector.

LED must light up.

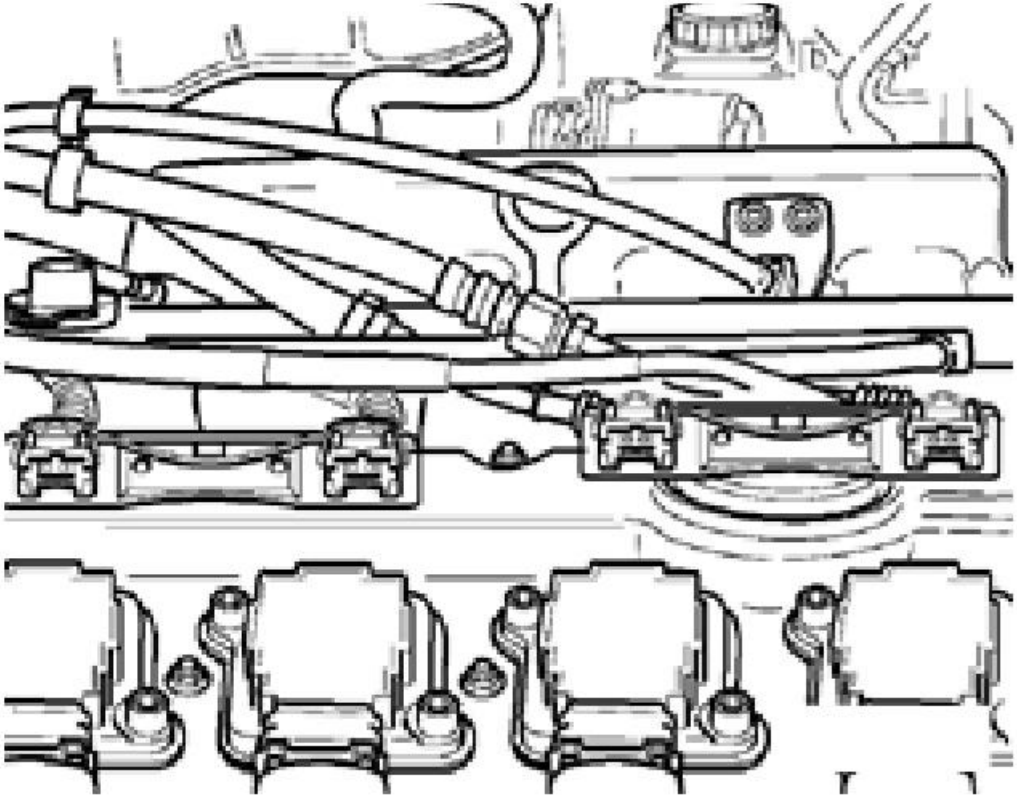
If the LED does not light up:

- Switch off ignition.
- Check wire between 2 pin connector terminal 1 and Fuel Pump (FP) Relay -J17- for open circuit using Electrical Wiring Diagram.

Wire resistance: max. 1.5

Checking activation and voltage supply

- Disconnect connectors from fuel injectors.



G03450054

Fig. 79: Disconnecting Connectors From Fuel Injectors
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Connect VAG1527 voltage tester to connector terminals of fuel injector to be tested using cables from VAG 1594.

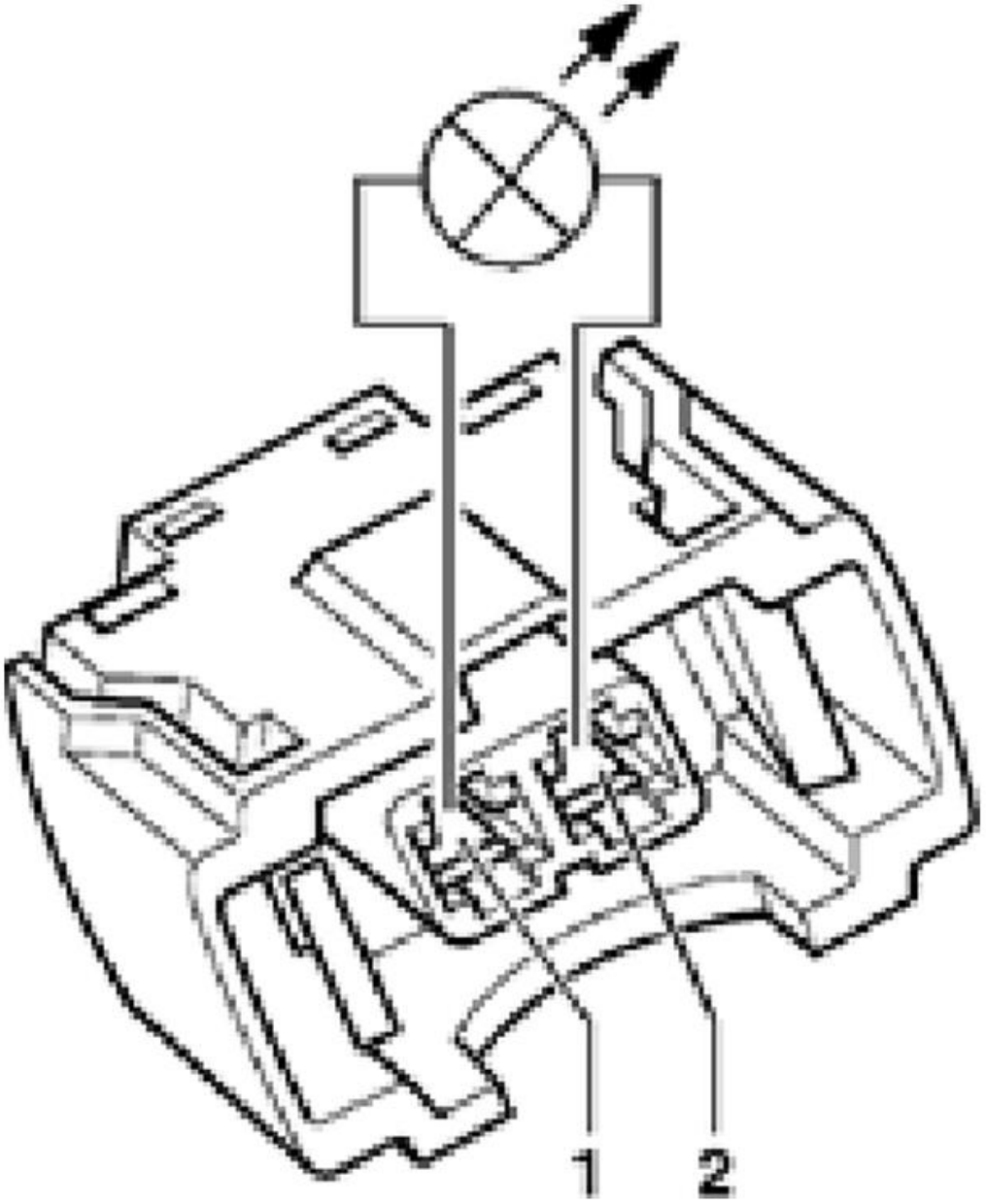


Fig. 80: Connecting VAG1527 Voltage Tester To Fuel Injector Harness Connector Terminals
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Operate starter and check activation for fuel injector.

LED must flicker

If the LED does not flicker:

- Switch off ignition.
- Remove inner plenum chamber cover, left:

See **PLENUM CHAMBER INNER COVER, REMOVING AND INSTALLING**

- Connect VAG 1598/31 test box to control module wiring harness. Motronic Engine Control Module (ECM) -J220- is not connected by this action.

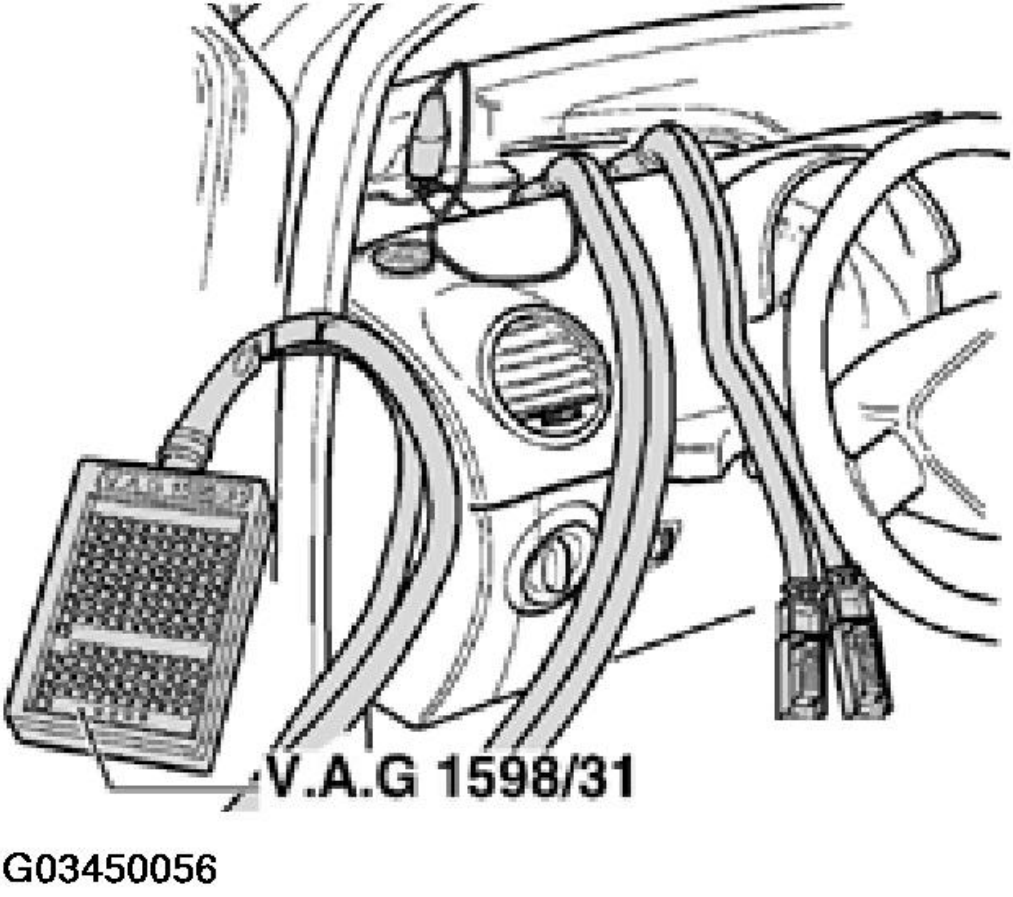
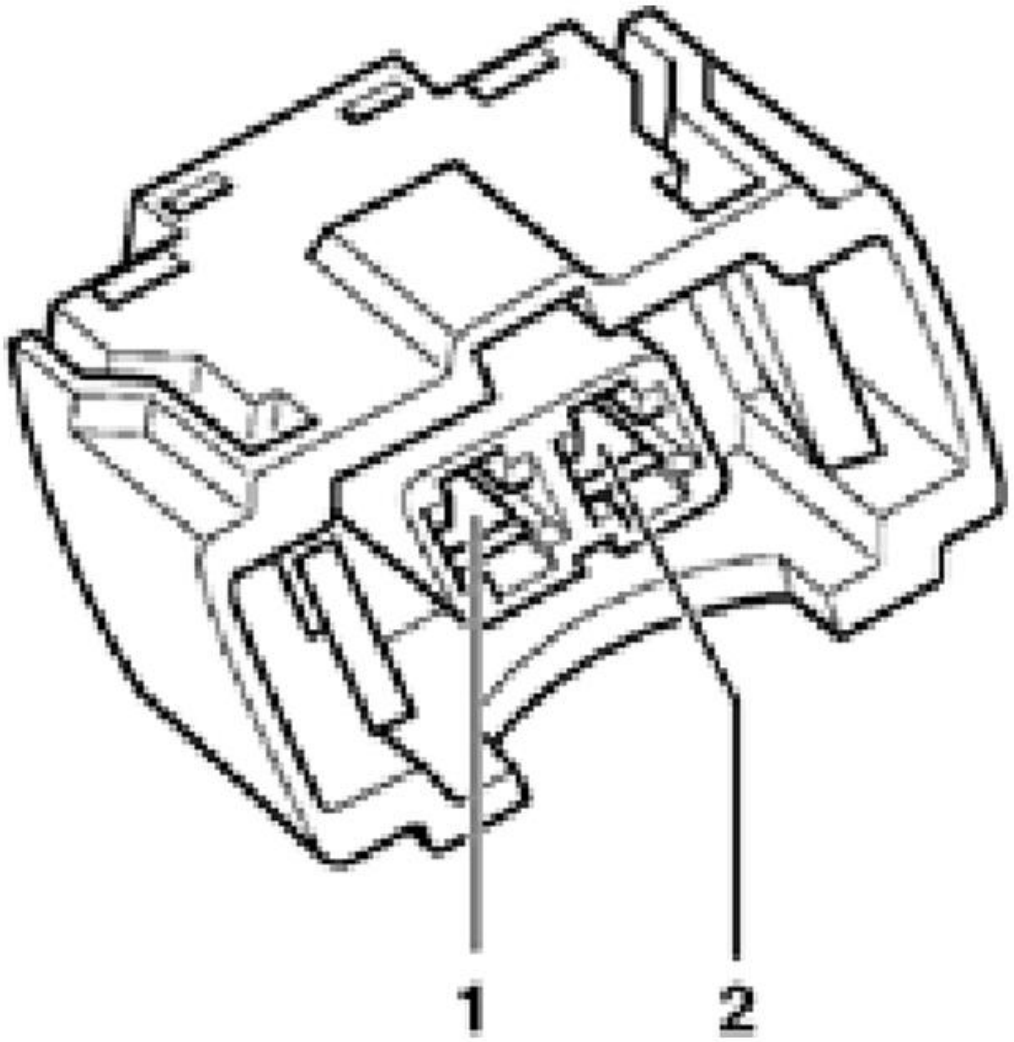


Fig. 81: Connecting VAG 1598/31 Test Box To Control Module Wiring Harness
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check wiring between the test box and 2-pin connectors for open circuit, short circuit to Ground (GND) or positive using Electrical Wiring Diagram:
  - Fuel injector 1: terminal 2 + socket 96
  - Fuel injector 2: terminal 2 + socket 89
  - Fuel injector 3: terminal 2 + socket 97
  - Fuel injector 4: terminal 2 + socket 88
  - Wire resistance: Max.1.5



G03450057

Fig. 82: Identifying Fuel Injector Harness Connector Terminals
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Additionally check wires for short to one another.

  Specification:

  If there is no malfunction in the wiring and the resistance measurement values are OK.:

- Replace Motronic Engine Control Module (ECM) -J220-, see **MOTRONIC ENGINE CONTROL MODULE (ECM) - J220-, REPLACING** .

Fuel injectors, checking for leaks and quantity injected

Special tools, test equipment and auxiliary items

- VAG 1348/3 Remote control
- VAG 1348/3-2 Adapter
- VAG 1602 Calibration tester

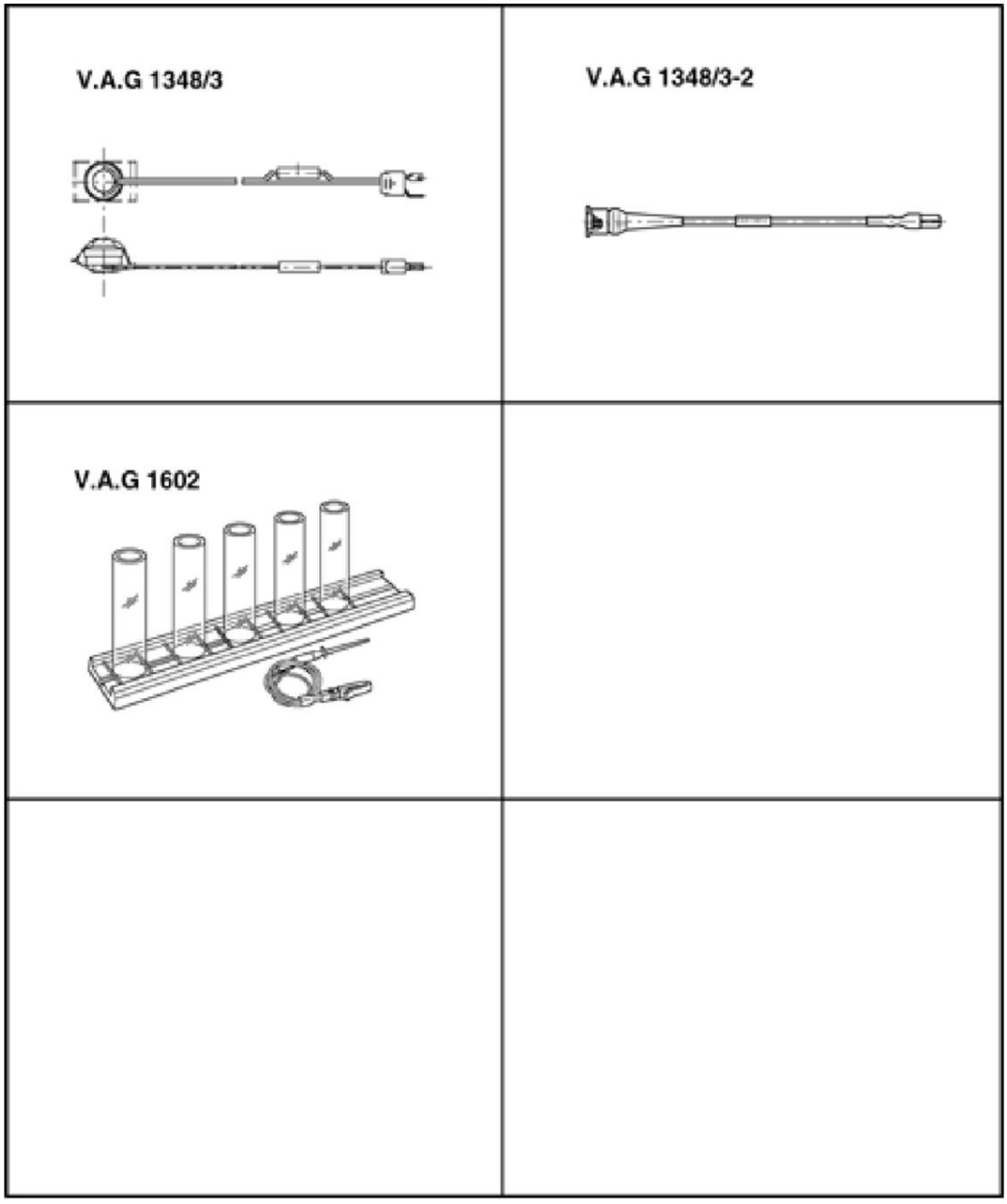


Fig. 83: Identifying Special Tools
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Test conditions

- Check that the fuel pressure is in order, see **FUEL PRESSURE REGULATOR AND HOLDING PRESSURE, CHECKING**

WARNING: Fuel system is under pressure! Before opening the system place a cloth around the connection. Then release pressure by carefully loosening the connection.

Test sequence

- Disconnect connectors from fuel injectors.

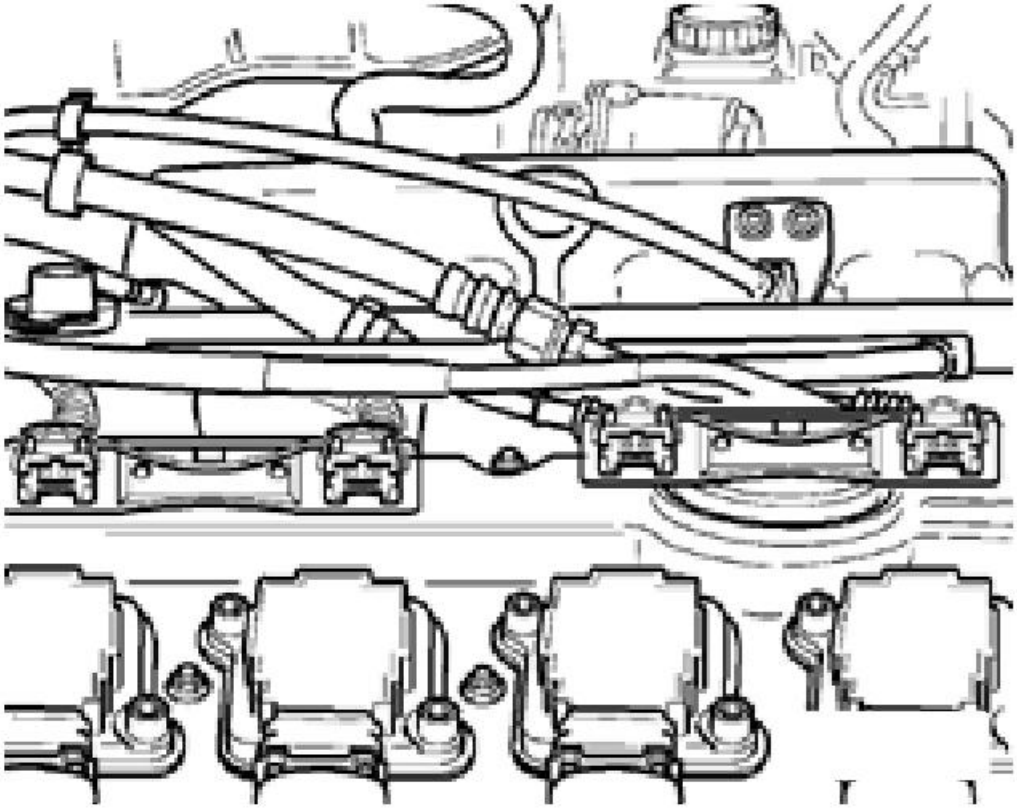


Fig. 84: Disconnecting Connectors From Fuel Injectors
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Remove fuel rail complete.
- Disconnect vacuum hose from fuel pressure regulator.
- Lift fuel rail with fuel injectors off intake manifold and support it.

Checking for leaks

- Initiate output Diagnostic Test Mode (DTM), see **OUTPUT DIAGNOSTIC TEST MODE (DTM) (FUNCTION 03), INITIATING** (fuel pump must run).

NOTE: This work sequence allows the fuel pump to run when the engine is not running.

- Check fuel injector for leaks (visual check). Only 1 to 2 drops per minute must emit from each valve when fuel pump is running.

If the fuel loss is greater:

- Switch off ignition.
- Replace malfunctioning fuel injector, see item 10 .

Pay attention to the following when installing the fuel injector:

- Replace O -rings on all fuel injectors and lightly moisten with clean engine oil.
- Insert fuel injectors vertically and in the correct position into the fuel rail and secure with retaining clips.
- Install fuel rail with secured fuel injectors onto intake manifold and press in evenly.
- The connectors must audibly engage in the fuel injectors when pushed on.

- Check DTC Memory, if necessary, repair any malfunctions and then Erase DTC Memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING** .
- Read readiness code, see **READINESS CODE, DISPLAYING** . If DTC memory has been erased or Motronic Engine Control Module (ECM) -J220- was disconnected from battery positive, readiness code must be generated again, see **READINESS CODE, GENERATING** .

Checking injected quantity

- Insert fuel injector to be checked in a measuring glass of VAG 1602 tester for injected quantity.
- Connect one terminal of fuel injector to be tested to engine Ground (GND) using auxiliary cables from VAG 1594.
- Connect second fuel injector terminal with auxiliary cable to VAG 1348/3 remote control using VAG 1348/3 -2 adapter cable.

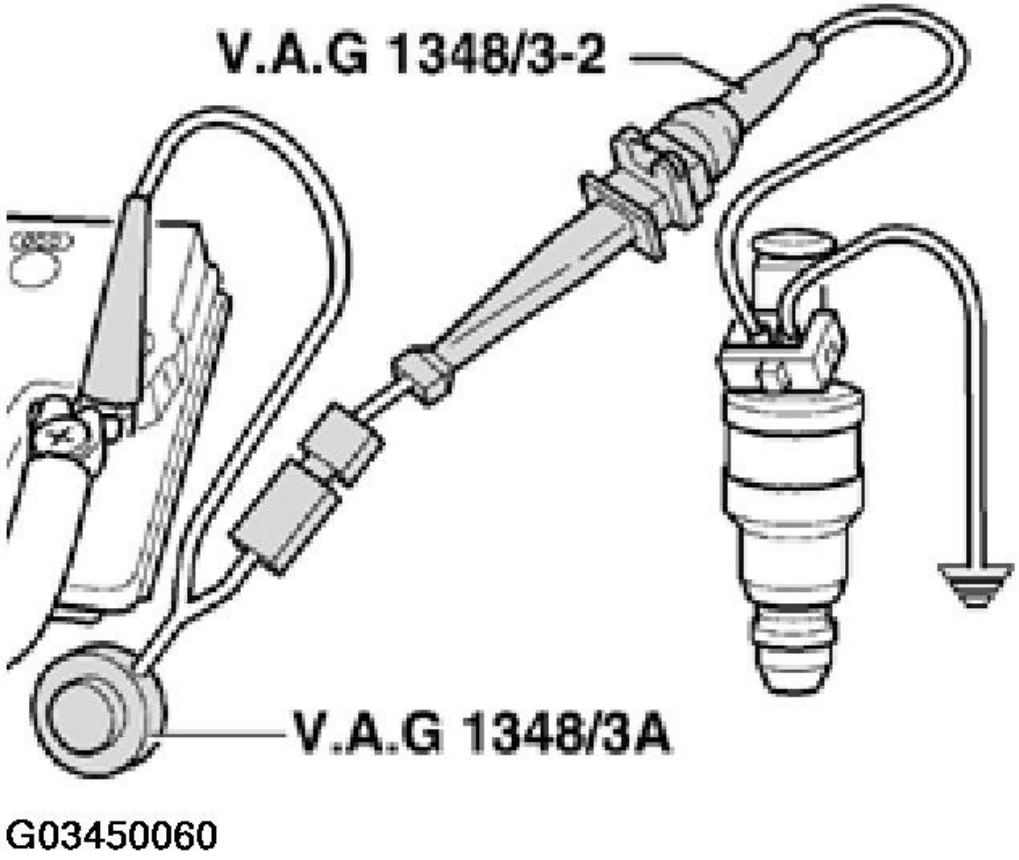


Fig. 85: Connecting One Terminal Of Fuel Injector To Engine Ground (Gnd) Using Auxiliary Cables From VAG 1594
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Connect alligator clip to battery (+).
- Initiate output DTM, see **OUTPUT DIAGNOSTIC TEST MODE (DTM) (FUNCTION 03), INITIATING** (fuel pump must run).

NOTE: This work sequence allows the fuel pump to run when the engine is not running.

- Operate VAG 1348/3 remote control for 30 seconds.

- Repeat check on other fuel injectors. Use new measuring glasses.
- After all fuel injectors have been activated, place measuring glasses on a horizontal surface and compare injected quantity.

Specification: 133 to 157 ml per injector

If the measuring values of one or more fuel injectors are above or below the prescribed specifications:

- Switch off ignition.
- Replace malfunctioning fuel injector, see item 10 .

Pay attention to the following when installing the fuel injector:

- Replace O -rings on all fuel injectors and lightly moisten with clean engine oil.
- Insert fuel injectors vertically and in the correct position into the fuel rail and secure with retaining clips.
- Install fuel rail with secured fuel injectors onto intake manifold and press in evenly.

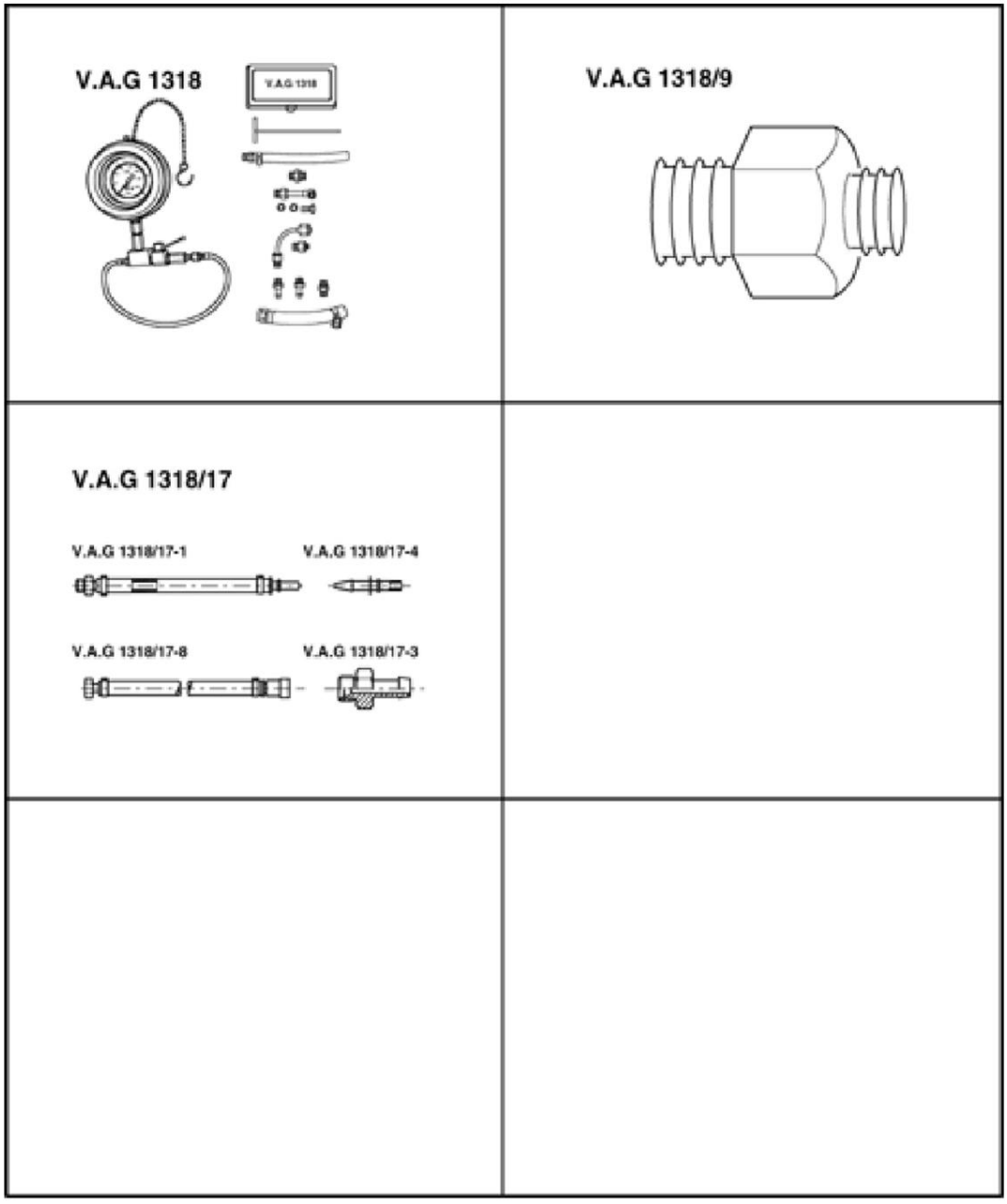
- Check DTC Memory, if necessary, repair any malfunctions and then Erase DTC Memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING** .
- Read readiness code, see **READINESS CODE, DISPLAYING** . If DTC memory has been erased or Motronic Engine Control Module (ECM) -J220- was disconnected from battery positive, readiness code must be generated again, see **READINESS CODE, GENERATING** .

Fuel pressure regulator and holding pressure, checking

The fuel pressure regulator controls the fuel pressure dependent upon intake manifold pressure.

Special tools, test equipment and auxiliary items

- VAG 1318 Pressure gauge
- 1318/9 Adapter
- 1318/17 Adapter



G03450061

Fig. 86: Identifying Special Tools
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Test sequence

- Remove fuse 28 (fuel pump) from fuse holder. Fuse holder is located behind access panel at far left end of dash.

WARNING: Fuel system is under pressure! Before opening the system place a cloth around the connection. Then release pressure by carefully loosening the connection.

Fig. 87: Locating Fuse 28 (Fuel Pump)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Pull off supply line/hose -1- and collect leaking fuel with a cloth.

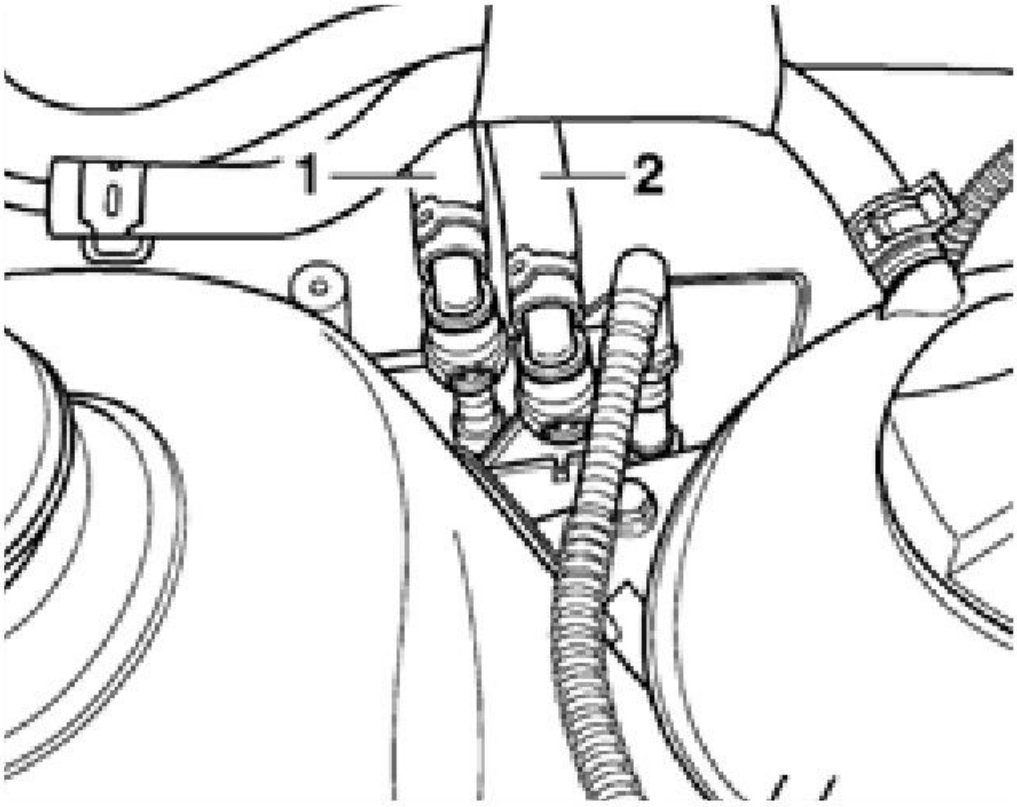


Fig. 88: Pulling Off Supply Line/Hose -1-
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Connect VAG 1318 pressure gauge to fuel supply line/hose and to hose to fuel rail using adapters 1318/9 and 1318/17.

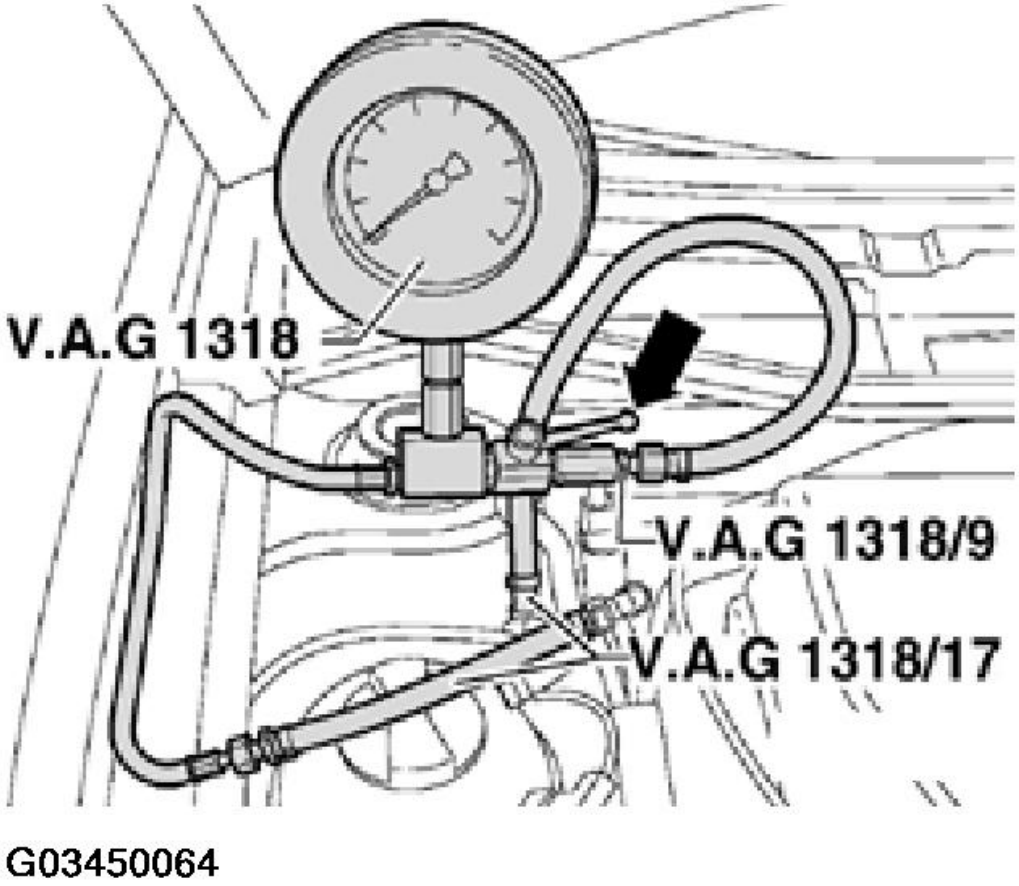


Fig. 89: Connecting VAG 1318 Pressure Gauge To Fuel Supply Line/Hose And To Hose To Fuel Rail Using Adapters 1318/9 And 1318/17
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Open measured device cut -off tap. (Handle points in through-flow direction -arrow-).
- Refit fuse 28 (fuel pump) in fuse holder.
- Start engine and run at idle speed.
- Measure fuel pressure.

Specification: Approx. 2.5 bar

If the specification is obtained:

- Pull vacuum hose -1- off fuel pressure regulator -2-.

Fuel pressure must increase to approx. 3.0 bar.

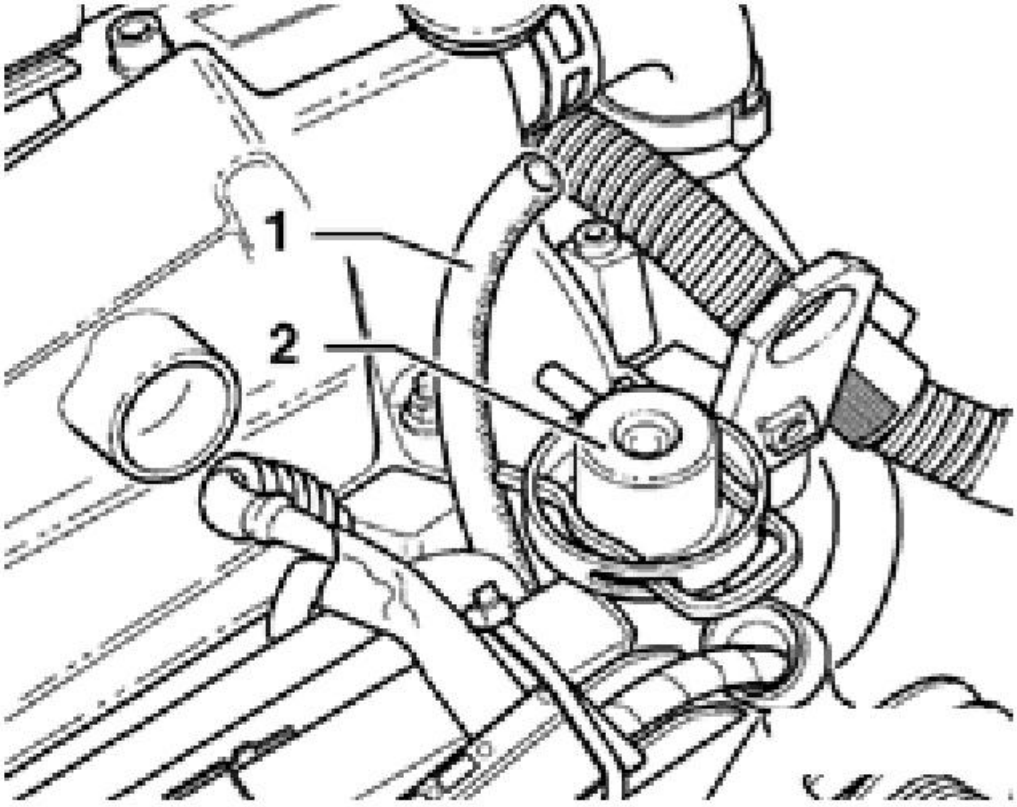


Fig. 90: Pulling Vacuum Hose Off Fuel Pressure Regulator
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Switch off ignition.

If the specification is not obtained:

- Check quantity supplied by fuel pump.

See **FUEL SUPPLY**

If the specification is obtained:

- Switch off ignition.

- Check for leaks and holding pressure by observing pressure drop on gauge.

After 10 minutes there must be a residual pressure of at least 2.0 bar.

If the holding pressure drops below 2 bar:

- Start engine and run at idle speed.
- Switch ignition off after pressure has built-up. At same time close pressure measured device cut-off tap (handle cross through -flow direction -arrow-).

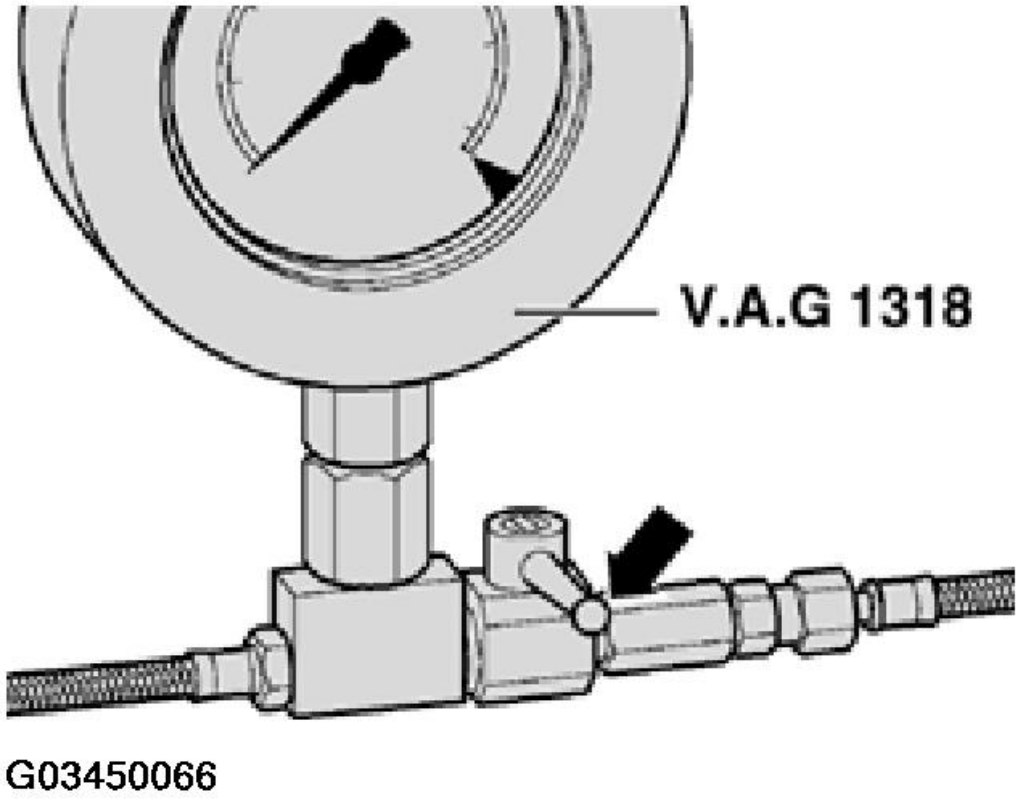


Fig. 91: Identifying Pressure Gauge
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Observe pressure drop on gauge.

If the pressure does not drop:

- Check fuel pump non -return valve.

See **CHECK FUEL PUMP**

If the pressure drops again:

- Open VAG 1318 pressure gauge shut-off tap (handle in through - flow direction).

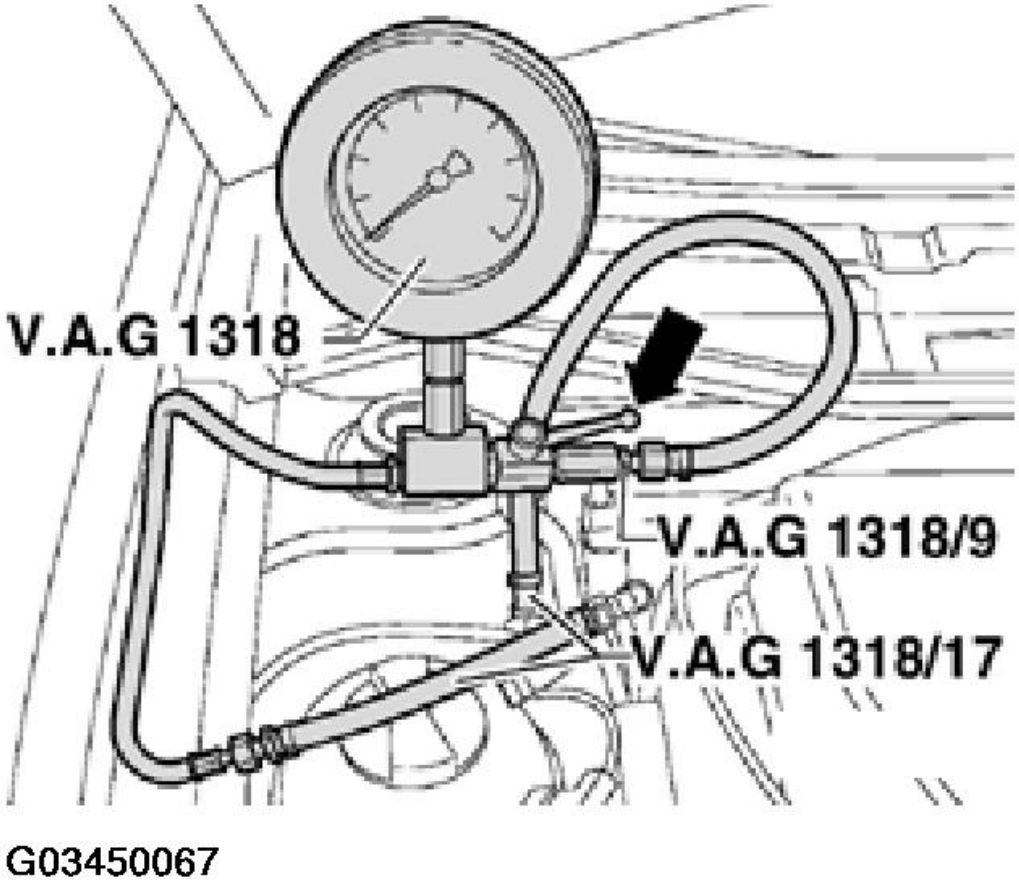


Fig. 92: Checking Pressure Gauge For Leaks
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Start engine and run at idle speed.
- Switch ignition off after pressure has built-up. At same time pinch/seal return hose together.

If the pressure does not drop:

- Replace fuel pressure regulator, see item 4 .

  If the pressure drops again:

- Check pipe connections, O -rings on fuel manifold and fuel injectors for leaks.
- Check pressure gauge for leaks.

NOTE: Before removing the pressure gauge, remove fuse 28 and place a cloth around the connections to be loosened.

Intake air system (unmetered air), checking for leaks

Checking with engine leak detector spray G 001 800 A1

NOTE:

- **The vacuum in the intake system will cause the leak detector spray to be drawn in with the unmetered air. The leak detector spray reduces the combustibility of the mixture. This leads to a drop in engine speed and to a change of oxygen sensor reading.**
- **The safety precautions listed on the container must be adhered to.**

Special tools, test equipment and auxiliary items

- VAG 1551 scan tool or VAG 1552 mobile scan tool with VAG 1551/3B cable
- Engine leak detector spray G 001 800 A1

Test conditions

- Engine Coolant Temperature (ECT) must be at least 80 °C, display group 04, display zone 3.

Test sequence

- Connect VAG 1551 scan tool (or VAG 1552). Start engine and select "Address word" 01 of Motronic Engine Control Module (ECM) -J220-. Engine must be running at idle speed. Connecting scan tool and selecting Motronic Engine Control Module (ECM) -J220-, see **VAG 1551, CONNECTING AND SELECTING MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-** .

Indicated on display

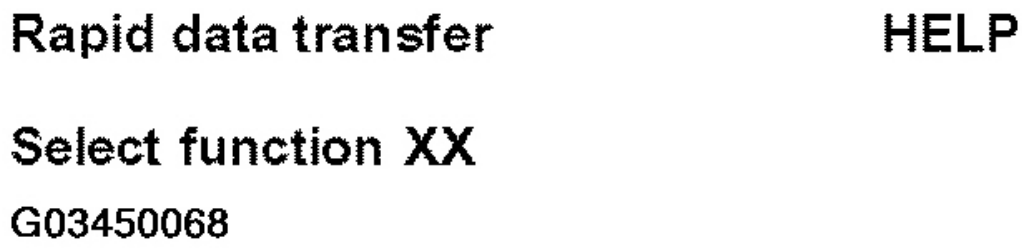


Fig. 93: Identifying Scan Tool Display - Checking For Unmetered Air Leaks (1 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0- and -8- for function "Read measuring value block" and confirm entry with -Q- button.

  Indicated on display

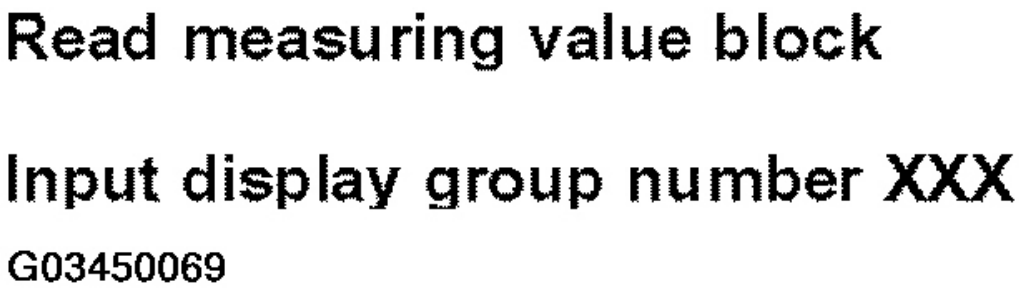


Fig. 94: Identifying Scan Tool Display - Checking For Unmetered Air Leaks (2 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0-, -0- and -1- for "Display group number 1" and confirm entry with -Q- button.

  Indicated on display (1 to 4 Display zones)

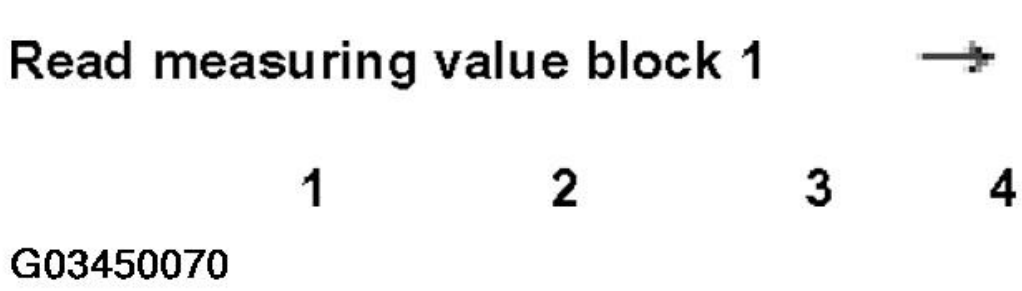


Fig. 95: Identifying Scan Tool Display - Checking For Unmetered Air Leaks (3 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check whether Engine Coolant Temperature (ECT) is above 80 °C in display zone 2.
- Observe engine speed in display zone 1 and oxygen sensor control before Three Way Catalytic Converter (TWC) in display zone 3.

DISPLAY GROUP 1: IDLING TEST

	Display zones			
	1	**2**	**3**	**4**
Display group 1: Idling test				
Display	xxxx RPM	xxx.x °C	xx.x %	xxxxxx
Indicated	Engine speed (in steps of 40)	**Engine Coolant Temperature (ECT)**	Oxygen sensor control before Three Way Catalytic Converter (TWC)	**Adjustment conditions for basic setting**
Working range	0 to 6800 RPM	-48.0 to 143.05C	-10.0 to 10.0%	-
Specification	760 to 810 RPM (1) 700 to 750 RPM (2)	80.0 to 115.05C	The value must fluctuate by at least 2% in the -10.0 to 10.0% range	-
(1) Engine idling at normal operating temperature for manual transmission (2) Engine idling at normal operating temperature for automatic transmission				

- Systematically spray parts of intake system with engine leak detector spray.

  If the engine speed drops or the oxygen sensor control changes:

- Press --> button.
- Press buttons -0- and -6- for function "End output" and confirm entry with -Q- button.

- Switch off ignition.
- Check sprayed areas of intake system for leaks and repair if necessary.

If the engine speed and the oxygen sensor control do not change:

- Press --> button.
- Press buttons -0- and -6- for function "End output" and confirm entry with -Q- button.
- Switch off ignition.

FUNCTIONS, CHECKING

Idle speed, checking

NOTE:

- **Idle speed, ignition timing and CO content not adjustable.**
- **The idle speed is regulated to specification by the throttle valve positioner in conjunction with the DIS function.**
- **CO content regulated by oxygen sensor control. Malfunctions in oxygen sensor control are detected in On Board Diagnostic (OBD) and stored in DTC memory.**

Special tools, test equipment and auxiliary items

- VAG 1551 scan tool or VAG 1552 mobile scan tool with VAG 1551/3B cable

Test conditions

- Exhaust system between Three Way Catalytic Converter (TWC) and cylinder head must be free of leaks
- All electrical accessories, e.g. lights and rear window defroster must be switched off
- If the vehicle is equipped with air conditioning, it must be turned off
- On vehicles with automatic transmission selector lever in "P" or "N" position
- Engine Coolant Temperature (ECT) must be at least 80 °C display group 04, display zone 3
- Intake air temperature less than 60 °C, see display group 04, display zone 4

Test sequence

- Connect VAG 1551 scan tool ((VAG 1552). Start engine and select "Address word" 01 of Motronic Engine Control Module (ECM) -J220-. Engine must be running at idle speed. Connecting scan tool and selecting Motronic Engine Control Module (ECM) -J220-, see **VAG 1551, CONNECTING AND SELECTING MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-** .
- - Check DTC Memory, if necessary, repair any malfunctions and then Erase DTC Memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING** .
- Read readiness code, see **READINESS CODE, DISPLAYING** . If DTC memory has been erased or

Motronic Engine Control Module (ECM) -J220- was disconnected from battery positive, readiness code must be generated again, see **READINESS CODE, GENERATING** .

- Leave VAG 1551 scan tool connected.
- Continue running engine at idle speed.

Indicated on display

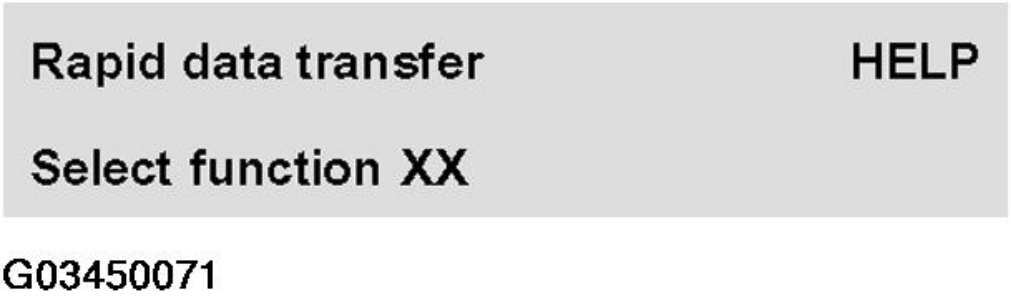


Fig. 96: Identifying Scan Tool Display - Checking Idle Speed (1 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0- and -4- for function "Basic Setting" and confirm entry with -Q- button.

Indicated on display

Fig. 97: Identifying Scan Tool Display - Checking Idle Speed (2 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0-, -0- and -1- for "Display group number 1" and confirm entry with -Q- button.

  Indicated on display (1 to 4 - Display zones)

G03450073

Fig. 98: Identifying Scan Tool Display - Checking Idle Speed (3 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check adjustment conditions for basic setting in display zone 4.

  Specification: 1x111111

  Significance of the numbers, see **CHECKING IDLE SPEED**

NOTE: **In the "System in basic setting" function the EVAP canister purge regulator valve -N80- is closed and the air conditioner compressor switched off.**

DISPLAY GROUP 1: IDLING TEST

	Display zones			
	1	**2**	**3**	**4**
Display group 1: Idling test				
Display	xxxx RPM	xxx.x °C	xx.x %	xxxxxx
Indicated	Engine speed (in steps of 40)	Engine Coolant Temperature (ECT)	Oxygen sensor control before Three Way Catalytic Converter (TWC)	Adjustment conditions
Working range	0 to 6800 RPM	**-48.0 to 143.0 C**	-10.0 to 10.0%	-
Specification	760 to 810 RPM (1)	80.0 to 115.0 C	Value must fluctuate by at least 2% in -10.0 to 10.0%	1x111111

	700 to 750 RPM (2)		range	
-		-	-	Significance, see **CHECKING IDLE SPEED**

(1) Engine idling at normal operating temperature for manual transmission

(2) Engine idling at normal operating temperature for automatic transmission

Significance of 8 digit number block

SIGNIFICANCE OF 8 DIGIT NUMBER BLOCK SPECIFICATION

Significance when display = 1								
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Significance**
							1	Engine Coolant Temperature (ECT) above 80 °C
						1		Speed below 2000 RPM
					1			Throttle valve closed
				1				Oxygen sensor control OK.
			1					Idling switch closed
		1						Air conditioner compressor switched off
	1							Three Way Catalytic Converter (TWC) temperature over 350 °C
1								No DTCs recognized by On Board Diagnostic (OBD)

If the specification is obtained:

- Briefly increase engine speed (RPM) (rev -up) and then allow engine to run at idle speed for 2 minutes.

Checking idle speed

- Continue running engine at idle speed.
- Change to display group 56 as follows:
- Press -C- button.

NOTE:

- **Idling speed cannot be adjusted.**
- **Idling speed is tested during the basic setting of the engine.**
- **In the "System in basic setting" function the EVAP canister purge regulator valve -N80- is closed and the air conditioner compressor switched off.**

WARNING: The electric coolant fan must not be running.

- Press buttons -0-, -5- and -6- for "Display group number 56" and confirm entry with -Q- button.

  Indicated on display (1 to 4 - Display zones)

G03450074

Fig. 99: Identifying Scan Tool Display - System In Basic Setting 56
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check operating mode in display zone 4.

  Specification: 0x000 (Significance, see **OXYGEN SENSOR AND OXYGEN SENSOR CONTROL BEFORE THREE WAY CATALYTIC CONVERTER (TWC), CHECKING**)

- Check specified idle speed in display zone 2.

  Specification:

  Manual transmission 760 RPM

  Automatic transmission 700 RPM

- Check actual idle speed in display zone 1.

  Specification:

  Manual transmission 760 to 810 RPM [1])

  Automatic transmission 700 to 750 RPM [1])

  [1]) Engine idling at normal operating temperature

NOTE: **During idling check the EVAP canister purge regulator valve and the air conditioner are switched off and the oxygen sensor control learning procedure is initiated.**

DISPLAY GROUP 56: IDLING TEST - ENGINE IDLING AT NORMAL OPERATING TEMPERATURE

	Display zones			
	1	**2**	**3**	**4**
Display group 56: Idling test - Engine idling at normal operating temperature				
Display	xxxx RPM	xxxx RPM	xxx.x %	xxxxx
Indicated	Actual engine speed (in steps of 10)	Specified engine speed (in steps of 10)	Idling regulator	Operating conditions
Working range	0 to 6800 RPM	-	-5.0 to 12.0%	-
Specification	760 to 810 RPM (1) 700 to 750 RPM (2)	760 RPM (1) 700 RPM (2)	-5.0 to 12.0%	0x000
	If the specifications are not obtained, see **OXYGEN SENSOR AND OXYGEN SENSOR CONTROL BEFORE THREE WAY CATALYTIC CONVERTER (TWC), CHECKING** , Continuation		-	Significance, see **OXYGEN SENSOR AND OXYGEN SENSOR CONTROL BEFORE THREE WAY CATALYTIC CONVERTER (TWC), CHECKING**

(1) For manual transmission

(2) For automatic transmission

NOTE:

- **The value shown in display zone 1 is the actual engine speed.**
- **The value shown in display zone 2 (specified engine speed) is a theoretical value calculated by the Motronic Engine Control Module (ECM) -J220-.**
- **When the engine is idling the Motronic Engine Control Module (ECM) -J220- tries constantly to adjust the actual engine speed so that it adapts the specified value.**
- **This means that the actual engine speed when idling should be approximately the same as the specified engine speed.**

Significance of 5 digit number block

SIGNIFICANCE OF 5 DIGIT NUMBER BLOCK SPECIFICATION

Significance when display = 1					
1	**2**	**3**	**4**	**5**	**Significance**
				1	Air conditioner compressor switched on

			1		Driving range (gear) selected
		1			Air conditioning system switched on
	1				Rear mirror defogger on
1					Power assisted steering pressure switch on

If the specification is obtained:

- Press --> button.
- Press buttons -0- and -6- for function "End output" and confirm entry with -Q- button.
- Switch off ignition.

Continuation

If the idle speed is not obtained:

- Adapt ECM to Throttle Valve Control Module - J338-, see **MOTRONIC ENGINE CONTROL MODULE (ECM) - J220- TO THROTTLE VALVE CONTROL MODULE - J338-, ADAPTING** .
- Road test vehicle.

Observe the valid safety precautions when road testing, see **SAFETY PRECAUTIONS** .

- Again check control module DTC memory.
- Repeat idle check.

If the specifications are not obtained again:

- Check Throttle Valve Control Module -J338-, see **THROTTLE VALVE CONTROL MODULE - J338-, CHECKING** .
- Check operating condition of engine, see **ENGINE OPERATING MODE, CHECKING** .
- Check intake air system for unmetered air, see **INTAKE AIR SYSTEM (UNMETERED AIR), CHECKING FOR LEAKS**
- Check signals from/to air conditioner, see **SIGNAL FROM/TO AIR CONDITIONING, CHECKING** .

Oxygen Sensor and oxygen sensor control before Three Way Catalytic Converter (TWC), checking

NOTE:

- **Raise vehicle to reach oxygen sensor connector.**
- **The Oxygen Sensor (O2S) before Three Way Catalytic Converter (TWC) has constant regulation and can be distinguished by a 6 -pin connector from the Oxygen Sensor (O2S) behind the Three Way Catalytic Converter (TWC).**
- **Only gold terminals may be used for servicing the terminals in the connector for the oxygen sensor.**

Special tools, test equipment and auxiliary items

- VAG 1551 scan tool or VAG 1552 mobile scan tool with VAG 1551/3B cable
- VAG 1598/31 test box
- VAG 1526 A or Fluke 83 multimeter
- VAG 1594 adapter set
- Electrical Wiring Diagram

Test conditions

- All fuses must be OK. Fuse holder located behind access panel at far left end of dash.

G03450075

Fig. 100: Locating Fuses
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Battery voltage must be at least 11.5 V
- Exhaust system between Three Way Catalytic Converter (TWC) and cylinder head must be free of leaks
- Engine Coolant Temperature (ECT) must be at least 80 °C display group 04, display zone 3

Functional check

- Connect VAG 1551 scan tool ((VAG 1552). Start engine and select "Address word" 01 of Motronic Engine Control Module (ECM) -J220-. Engine must be running at idle speed. Connecting scan tool and selecting Motronic Engine Control Module (ECM) -J220-, see **VAG 1551, CONNECTING AND SELECTING MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-** .

  Indicated on display

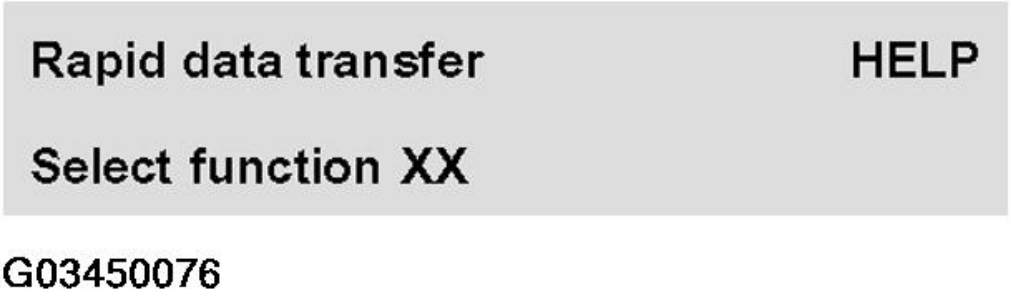


Fig. 101: Identifying Scan Tool Display - Checking HO2S Before TWC (1 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0- and -8- for function "Read measuring value block" and confirm entry with -Q- button.

  Indicated on display

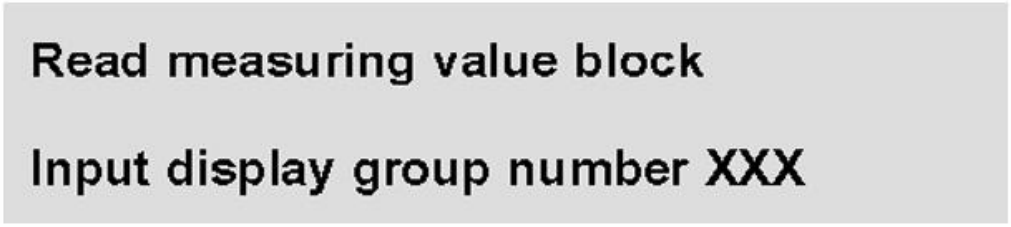


Fig. 102: Identifying Scan Tool Display - Checking HO2S Before TWC (2 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0-, -3- and -0- for "Display group number 30" and confirm entry with -Q- button.

  Indicated on display (1 to 2 - Display zones)

Fig. 103: Identifying Scan Tool Display - Checking HO2S Before TWC(3 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check status of the oxygen sensor control before Three Way Catalytic Converter (TWC) (display zone 1):

Specification: 1 1 1

DISPLAY GROUP 30: OXYGEN SENSOR CONTROL

	Display zones			
	1	2	3	4
Display group 30: oxygen sensor control				
Display	xxx	xxx	-	-
Indicated	Status of oxygen sensor control before Three Way Catalytic Converter (TWC)	Status of oxygen sensor control after Three Way Catalytic Converter (TWC)	-	-
Working range	-	-	-	-
Specification	111	110	-	-
	Significance, see **CHECKING OXYGEN SENSOR WIRING FOR OXYGEN SENSOR 1**	-	-	-
	If the specification is not obtained, see **Heated Oxygen Sensor (HO2S) for oxygen sensor before Three Way Catalytic Converter (TWC), checking**	-	-	-

NOTE: For display zone 1:

- **The first figure in the 3 figure number block periodically changes between 0 and 1 (Heated Oxygen Sensor (HO2S) on and off).**
- **The numbers in the 3 figure number block can alternate from 0 and 1 in the display depending on the status of the oxygen sensor control.**

Significance of 3 digit number block in display zone 1

SIGNIFICANCE OF 3 DIGIT NUMBER BLOCK IN DISPLAY ZONE 1 SPECIFICATION

Significance if display = 1			
1	**2**	**3**	**Significance**
		1	Oxygen sensor control active
	1		Oxygen sensor operationally ready
1			Heated Oxygen Sensor (HO2S) on

If the specification is obtained:

- Change to display group 32 as follows:
- Press -C- button.
- Press buttons -0-, -3- and -2- for "Display group number 32" and confirm entry with -Q- button.

  Indicated on display (1 to 2 -- Display zones)

Fig. 104: Identifying Scan Tool Display - Read Measuring Value Block 32
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check oxygen sensor control learned values at idling speed (additive) in display zone 1.

  Specification: -3.0...3.0%

- Check oxygen sensor control learned values at part load (multiplicative) in display zone 2.

  Specification: -10.0...10.0%

DISPLAY GROUP 32: OXYGEN SENSOR CONTROL LEARNED VALUES BEFORE THREE WAY CATALYTIC CONVERTER (TWC)

	Display zones			
	1	**2**	**3**	**4**
Display group 32: oxygen sensor control learned values before Three Way Catalytic Converter (TWC)				
Display	xx.x %	xx.x %	-	-
Indicated	Oxygen sensor control learned value at idling (additive)	Oxygen sensor control learned value at part load (multiplicative)	-	-
Working range	-25.0 to 25.0%	-25.0 to 25.0%	-	-
Specification	**-3.0 to 3.0%** **can fluctuate slightly** If the specifications are not achieved	**-10.0 to 10.0%** **can fluctuate slightly** See **CHECKING OXYGEN SENSOR WIRING FOR OXYGEN SENSOR 1** , Evaluating display group 32	- -	- -

NOTE: In display zones 1 and 2:

- **Oxygen Sensor control learned values are fuel dependent!**
- **Low values indicate that the engine is running too rich and therefore the oxygen sensor control is leaning the mixture.**
- **High values indicate that the engine is running too lean and therefore the oxygen sensor control enriches the mixture.**
- **If there is no voltage supply to the control module all the values learned will be cancelled.**
- **add = additive - The effects of the malfunction (e.g. unmetered air) will reduce as the engine speed increases. The injection period will be modified by a fixed amount for additive learned values. This amount is not dependent upon the basic injection period.**
- **mul = multiplicative - The effects of the malfunction (e.g. malfunctioning fuel injector) will increase as the engine speed increases. A multiplicative learned value is a proportional change to the injection period. This change is dependent on the basic injection period.**

  Initiating learning process: Control module in mode 04, Basic settings

- **Learning prerequisites for idle speed: idle speed, Engine Coolant Temperature (ECT) min. 75 C, intake air temperature max. 90 °C.**
- **Learning prerequisites for part load: Engine Coolant Temperature (ECT) min. 75 °C, intake air temperature max. 90 °C**
- **EVAP canister purge regulator valve must be closed and the A/C compressor must be off.**

If the specification is obtained:

- Change to display group 33 as follows:

  VAG 1551: Press button -3-

  VAG 1552: Press button

  Indicated on display (1 to 2 Display zones)

Fig. 105: Identifying Scan Tool Display - Read Measuring Value Block 33
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Observe oxygen sensor control in display zone 1. Display must fluctuate at least 2% in the range -10.0 to 10.0%

DISPLAY GROUP 33: OXYGEN SENSOR CONTROL BEFORE THREE WAY CATALYTIC CONVERTER (TWC)

	Display zones			
	1	2	3	4
Display group 33: oxygen sensor control before Three Way Catalytic Converter (TWC)				
Display	xx.x %	x.xxx V	-	-
Indicated	Oxygen sensor control before Three Way Catalytic Converter (TWC)	Oxygen sensor voltage before Three Way Catalytic Converter (TWC)	-	-
Working range	-25.0 to 25.0%	-	-	-
Specification	The value must fluctuate at least 2% in -10.0 to 10.0% range	-	-	-
	If the specification is not obtained, see **CHECKING OXYGEN SENSOR WIRING FOR OXYGEN SENSOR 1** , Continuation	-	-	-

NOTE: **In display zone 1: the display must fluctuate around 0.0%. If 0.0% is displayed constantly, the oxygen sensor control has switched from regulation to control, because there is a malfunction in the oxygen sensor control. Check DTC Memory, see DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING .**

If the specification is obtained:

- Press --> button.
- Press buttons -0- and -6- for function "End output" and confirm entry with -Q- button.
- Switch off ignition.

Continuation

If the oxygen sensor control in display zone 1 does not fluctuate as stated:

- Press --> button.
- Press buttons -0- and -6- for function "End output" and confirm entry with -Q- button.
- Test drive vehicle to remove possible residue on oxygen sensor and repeat check.

Observe the valid safety precautions when carrying out a road test, see **SAFETY PRECAUTIONS** .

If the specifications in display zone 1 are not obtained even after a test drive, or the value does not fluctuate by at least 2%:

- Check oxygen sensor before Three Way Catalytic Converter (TWC) for aging, see **OXYGEN SENSOR AGING, OXYGEN SENSOR BEFORE THREE WAY CATALYTIC CONVERTER (TWC), CHECKING** .

Evaluating display zone 33, display zones 1 - oxygen sensor control learned values before Three Way Catalytic Converter (TWC)

EVALUATING DISPLAY ZONE 33, DISPLAY ZONES 1 - OXYGEN SENSOR CONTROL LEARNED VALUES BEFORE THREE WAY CATALYTIC CONVERTER (TWC) - 1 OF 2

Appears on display	Possible cause	Corrective action
Low oxygen sensor control learned values	• Low learned values at idling but with normal learned values at part throttle: possible oil dilution (high level of fuel in oil) • Fuel injector leaking • Fuel pressure too high • EVAP solenoid valve 1 permanently open • Mass Air Flow (MAF) sensor malfunctioning • Heated Oxygen Sensor (HO2S) malfunctioning or oxygen sensor soiled	• Check if it disappears after highway drive or oil change • Check fuel injector, see **FUEL INJECTORS, CHECKING** • Check fuel pressure regulator and holding pressure, see **FUEL PRESSURE REGULATOR AND HOLDING PRESSURE, CHECKING** • Check EVAP solenoid valve 1, see **OUTPUT DIAGNOSTIC TEST MODE (DTM)** • Check Mass Air Flow (MAF) sensor, see **MASS AIR FLOW (MAF) SENSOR, CHECKING**

		• Check Heated Oxygen Sensor (HO2S), see **FUEL INJECTION SYSTEM COMPONENTS, CHECKING**

EVALUATING DISPLAY ZONE 33, DISPLAY ZONES 1 - OXYGEN SENSOR CONTROL LEARNED VALUES BEFORE THREE WAY CATALYTIC CONVERTER (TWC) - 2 OF 2

Appears on display	Possible cause	Corrective action
High oxygen sensor control learned values	• High learned values at idle speed, not so high learned values at part throttle: possible unmetered air in area of intake manifold • Unmetered air between Mass Air Flow (MAF) sensor and throttle valve • Fuel injector blocked • Mass Air Flow (MAF) sensor malfunctioning • Fuel pressure too low • Heated Oxygen Sensor (HO2S) malfunctioning or oxygen sensor soiled • Unmetered air at exhaust manifold gasket	• Check intake air system for leaks, see **INTAKE AIR SYSTEM (UNMETERED AIR), CHECKING FOR LEAKS** • Repair cause • Check quantity injected, see **FUEL INJECTORS, CHECKING** • Check Mass Air Flow (MAF) sensor, see **MASS AIR FLOW (MAF) SENSOR, CHECKING** • Check fuel pressure regulator and holding pressure, see **FUEL PRESSURE REGULATOR AND HOLDING PRESSURE, CHECKING** • Check Heated Oxygen Sensor (HO2S), see **FUEL INJECTION SYSTEM COMPONENTS, CHECKING**

Possible causes of malfunction if sensor control frequency is too slow:

- Slots or holes in sensor body are blocked
- Sensor vent hole in area of connecting wire is blocked
- Sensor has been overheated (glazed)
- Sensor has been damaged by leaded fuel

Checking Oxygen Sensor wiring for oxygen sensor 1

- Remove inner plenum chamber cover, left:

  See **PLENUM CHAMBER INNER COVER, REMOVING AND INSTALLING**

- Connect VAG 1598/31 test box to control module wiring harness. Motronic Engine Control Module (ECM) -J220- is not connected by this action.

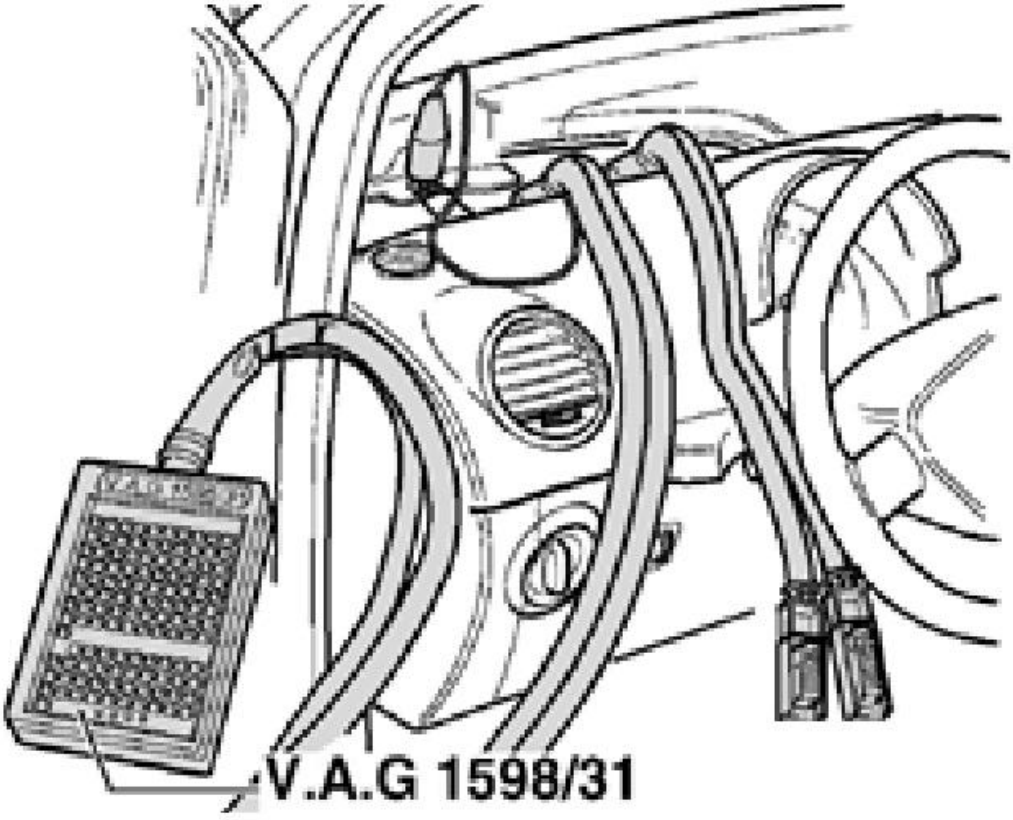


Fig. 106: Connecting VAG 1598/31 Test Box To Control Module Wiring Harness
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Remove protective cover -arrows- and separate 6-pin connector (black) -1- to Heated Oxygen Sensor (HO2S) before Three Way Catalytic Converter (TWC) -G39-.

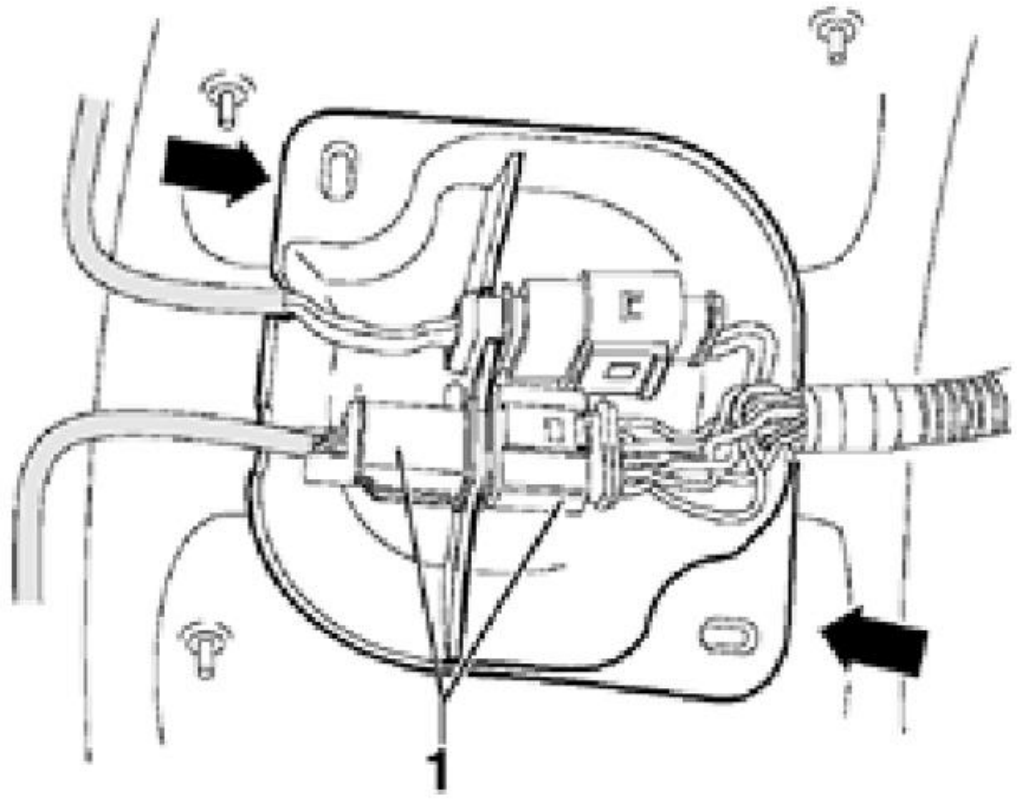


Fig. 107: Separating 6-Pin Connector To HO2S -G39- Before TWC
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check wiring for open circuit between test box and 6 -pin connector (to control module) according to Electrical Wiring Diagram.
  - terminal 1 + socket 70
  - terminal 2 + socket 71
  - terminal 5 + socket 51
  - terminal 6 + socket 52

  Wire resistance: Max. 1.5

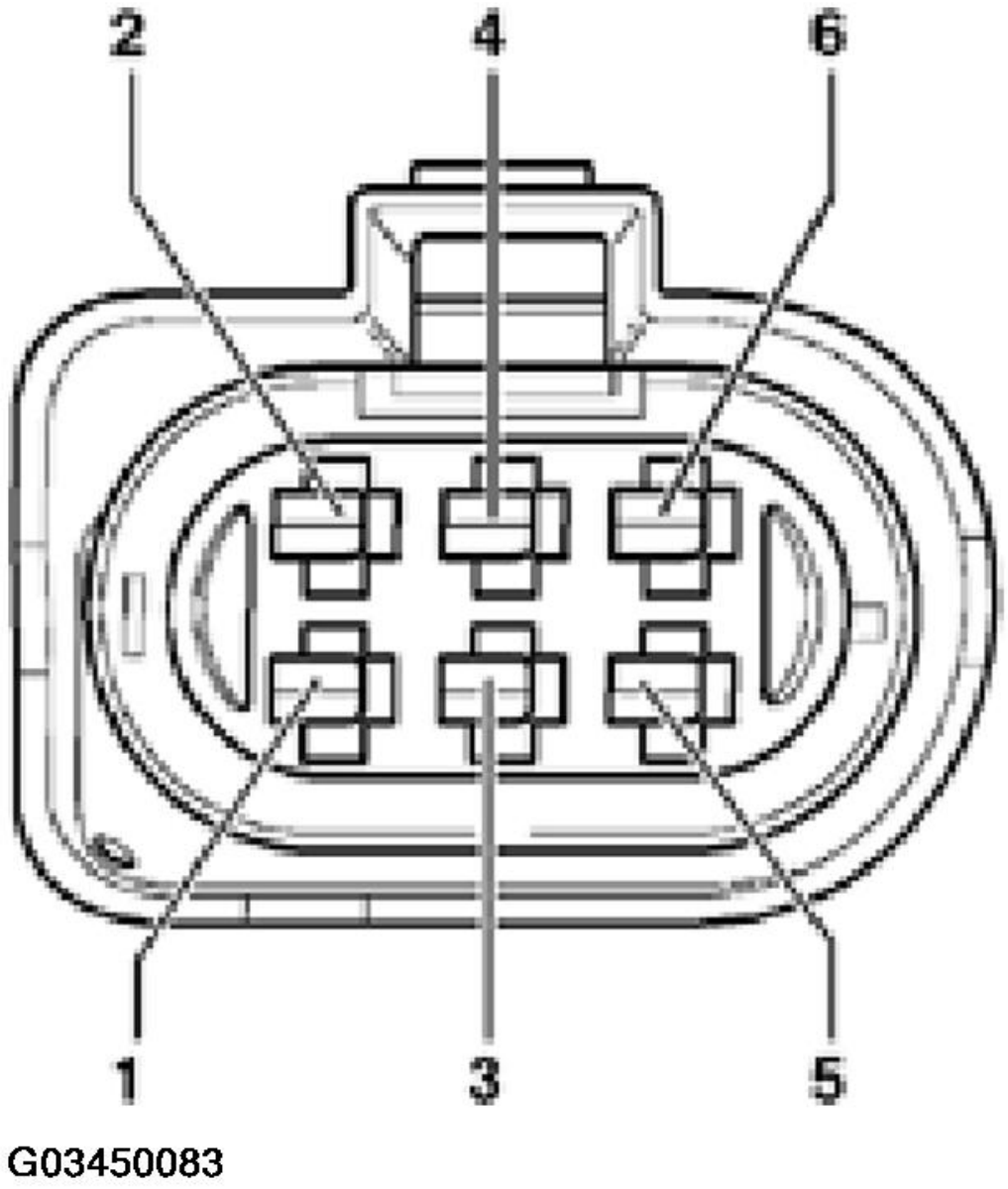


Fig. 108: Identifying HO2S -G39- Before TWC Harness Connector Terminals
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Additionally check wires all for short to one another.

  Specification: INFINITY ohm

If no wiring malfunction is found:

- Replace Heated Oxygen Sensor (HO2S) before Three Way Catalytic Converter (TWC) -G39-, see item 10 .
- Check DTC Memory, if necessary, repair any malfunctions and then Erase DTC Memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING** .
- Read readiness code, see **READINESS CODE, DISPLAYING** . If DTC memory has been erased or Motronic Engine Control Module (ECM) -J220- was disconnected from battery positive, readiness code must be generated again, see **READINESS CODE, GENERATING** .

Oxygen sensor and oxygen sensor control after Three Way Catalytic Converter (TWC), checking

NOTE:

- **Raise vehicle to reach oxygen sensor connector.**
- **Only gold terminals may be used for servicing terminals 3 and 4 in connector for oxygen sensor.**

Special tools, test equipment and auxiliary items

- VAG 1551 scan tool or VAG 1552 mobile scan tool with VAG 1551/3B cable
- VAG 1598/31 test box
- VAG 1526 A or Fluke 83 multimeter
- VAG 1594 adapter set
- Electrical Wiring Diagram

Test conditions

- All fuses must be OK. Fuse holde is located behind access panel at far left end of dash.

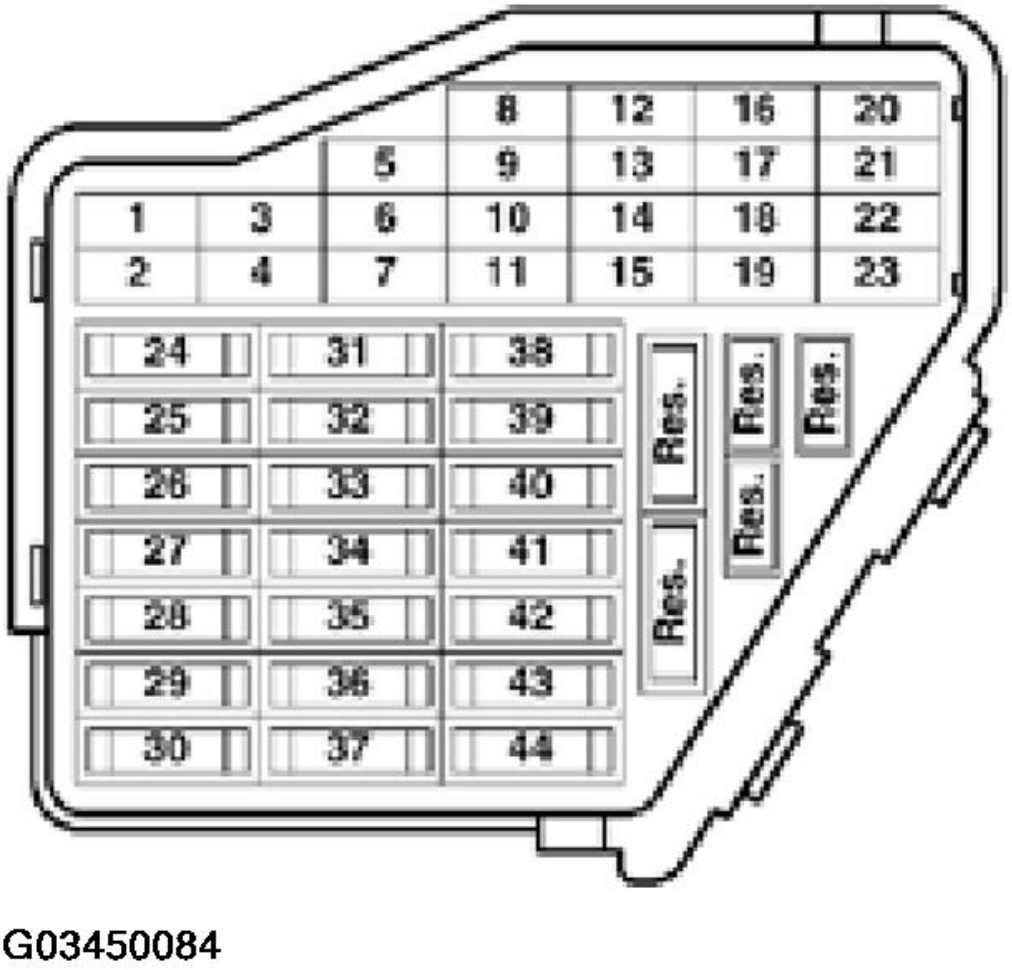


Fig. 109: Locating Fuses
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Battery voltage must be at least 11.5 V.
- Exhaust system between Three Way Catalytic Converter (TWC) and cylinder head must be free of leaks
- Engine Coolant Temperature (ECT) must be at least 80 °C display group 04, display zone 3

Functional check

- Connect VAG 1551 scan tool ((VAG 1552). Start engine and select "Address word" 01 of ECM. Engine must be running at idle speed. Connecting scan tool and selecting Engine Control Module, see **VAG 1551, CONNECTING AND SELECTING MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-** .

Indicated on display

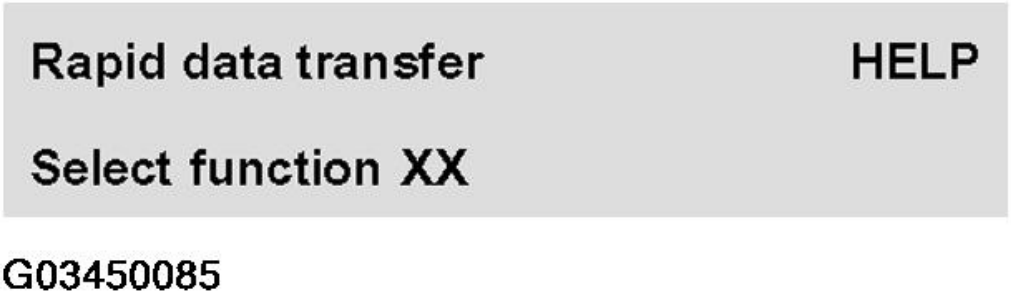


Fig. 110: Identifying Scan Tool Display - Checking HO2S After TWC (1 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0- and -8- for function "Read measured value block" and confirm entry with -Q- button.

  Indicated on display

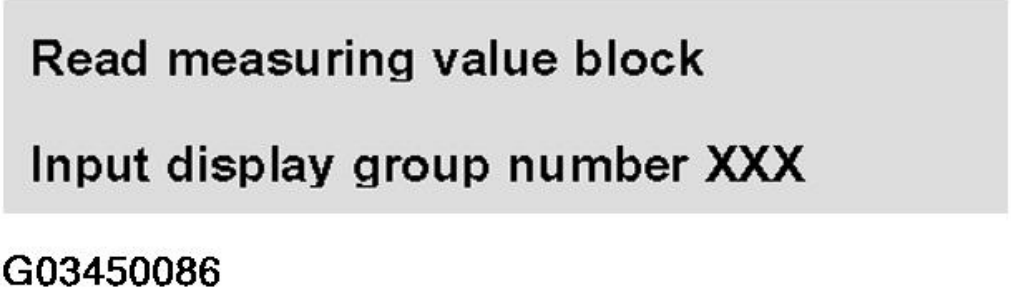


Fig. 111: Identifying Scan Tool Display - Checking HO2S After TWC (2 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0-, -3- and -0- for "Display group number 30" and confirm entry with -Q- button.

  Indicated on display (1 to 2 - Display zones)

Fig. 112: Identifying Scan Tool Display - Checking HO2S After TWC (3 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check status of oxygen sensor control after Three Way Catalytic Converter (TWC) (display zone 2).

  Specification: 1 1 0

DISPLAY GROUP 30: OXYGEN SENSOR CONTROL

	Display zones			
	1	**2**	**3**	**4**
Display group 30: Oxygen sensor control				
Display	xxx	xxx	-	-
Indicated	Status of oxygen sensor control before Three Way Catalytic Converter (TWC)	Status of oxygen sensor control after Three Way Catalytic Converter (TWC)	-	-
Working range	-	-	-	-
Specification	111	110	-	-
	-	Significance, see **POSSIBLE CAUSES OF MALFUNCTION IF SENSOR CONTROL FREQUENCY IS TOO SLOW:**	-	-
	-	If the specification is not obtained, see **HEATED OXYGEN SENSOR (HO2S) FOR OXYGEN SENSOR AFTER THREE WAY CATALYTIC CONVERTER (TWC), CHECKING**	-	-

Notes on display zone 2:

- *The first figure in the 3 figure number block periodically changes between 0 and 1 (Heated Oxygen*

Sensor (HO2S) on and off).

- *The numbers in the 3 figure number block can alternate from 0 and 1 in the display depending on the status of the oxygen sensor control.*
- *The third position of the 3 digit number block will be set to 1 only at increased exhaust temperature and part load.*

Significance of 3 digit number block in display zone 2

Significance of 3 digit number block in display zone 2 SPECIFICATION

Significance if display = 1			
1	**2**	**3**	**Significance**
		1	Oxygen sensor control active
	1		Oxygen sensor operationally ready
1			Heated Oxygen Sensor (HO2S) on

If the specification is obtained:

- Change to display group 36 as follows:
- Press --> button.
- Press buttons -0- and -4- for "Basic Setting" function and confirm entry with -Q- button.

  Indicated on display

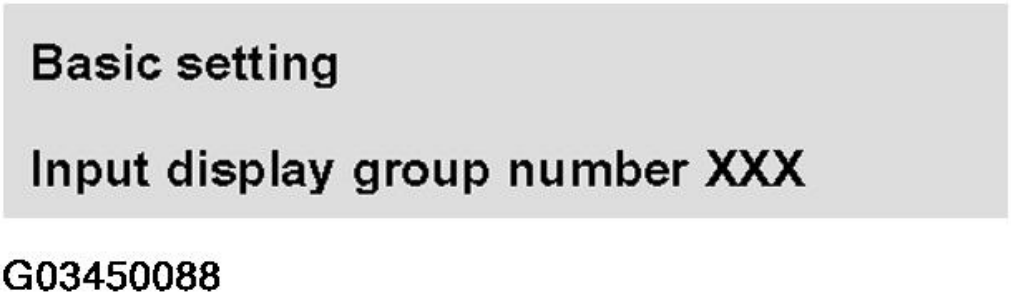


Fig. 113: Identifying Scan Tool Display - Basic Setting
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0-, -3- and -6- for "Display group number 36" and confirm entry with -Q- button.

  Indicated on display (1 to 2 - Display zones)

Fig. 114: Identifying Scan Tool Display - System In Basic Setting 36
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check oxygen sensor voltage after Three Way Catalytic Converter (TWC) in display zone 1.

  Specification: 0.100...0.900 V (can fluctuate slightly)

- Maintain engine speed at 1800 -2200 RPM.

  If the diagnostic is initiated from Engine Control Module the display in display zone 4 jumps from "Test OFF" to "Test ON."

  Specification: "B1-S2 OK." appears in display zone 2.

NOTE: It can take a few minutes until display jumps from "Test ON" to "B1 -S2 OK".

DISPLAY GROUP 36: OXYGEN SENSOR CONTROL, OPERATIONAL READINESS AFTER THREE WAY CATALYTIC CONVERTER (TWC)

	Display zones			
	1	**2**	**3**	**4**
Display group 36: Oxygen sensor control, operational readiness after Three Way Catalytic Converter (TWC)				
Display Indicated	x.xxx V Oxygen sensor voltage for oxygen sensor after Three Way Catalytic Converter (TWC)	Test OFF/Test ON B1-S2 OK. B1-S2 n. OK. Diagnostic condition and Diagnostic result	-	
Working range	- 0.100 to 0.900 V (must fluctuate slightly)	- **B1-S2 OK.**	-	

Specification	If specifications are not achieved, see **POSSIBLE CAUSES OF MALFUNCTION IF SENSOR CONTROL FREQUENCY IS TOO SLOW:** , Evaluating display group 36	If specifications are not achieved, see **POSSIBLE CAUSES OF MALFUNCTION IF SENSOR CONTROL FREQUENCY IS TOO SLOW:** , Continuation	

If the specification is obtained:

- Press --> button.
- Press buttons -0- and -6- for function "End output" and confirm entry with -Q- button.
- Switch off ignition.

Continuation

If the specification is not obtained:

- Press --> button.
- Press buttons -0- and -6- for function "End output" and confirm entry with -Q- button.
- Check DTC Memory, if necessary, repair any malfunctions and then Erase DTC Memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING** .
- Perform a road test to remove possible contaminates on oxygen sensor and repeat check.

  Observe the valid safety precautions when carrying out a road test, see **SAFETY PRECAUTIONS** .

  If the specifications are again not obtained:

- Replace Oxygen Sensor (O2S) after Three Way Catalytic Converter (TWC) -G130-, see item 8 .
- Check DTC Memory, if necessary, repair any malfunctions and then Erase DTC Memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING** .
- Read readiness code, see **READINESS CODE, DISPLAYING** . If DTC memory has been erased or Motronic Engine Control Module (ECM) -J220- was disconnected from battery positive, readiness code must be generated again, see **READINESS CODE, GENERATING** .

Evaluating display group 36, display zone 1 - oxygen sensor voltage oxygen sensor after Three Way Catalytic Converter (TWC)

EVALUATING DISPLAY GROUP 36, DISPLAY ZONE 1 - OXYGEN SENSOR VOLTAGE OXYGEN SENSOR AFTER THREE WAY CATALYTIC CONVERTER (TWC)

Appears on display	Possible cause	Corrective action
Constant 1.105 V	• Short to positive via: oxygen sensor, sensor wiring, Ground (GND) wiring,	• Check oxygen sensor basic voltage, see **CHECKING BASIC**

	Motronic Engine Control Module (ECM) -J220-	**VOLTAGE FOR OXYGEN SENSOR 2** • Check oxygen sensor wiring, see **CHECKING OXYGEN SENSOR WIRING, OXYGEN SENSOR 2**
Constant between 0.400 to 0.500 V	• Open circuit via: oxygen sensor, sensor wiring, Ground (GND) wiring, Motronic Engine Control Module (ECM) -J220-	
Constant 0.000 V	• Short to Ground (GND) via: oxygen sensor, sensor wiring, Ground (GND) wiring, Motronic Engine Control Module (ECM) -J220-	

Possible causes of malfunction if sensor control frequency is too slow:

- Slots or holes in sensor body are blocked
- Sensor vent hole in area of connecting wire is blocked
- Sensor has been overheated (glazed)
- Sensor has been damaged by leaded fuel

Checking basic voltage for oxygen sensor 2

- Remove protective cover -arrows- and separate 4-pin connector (black/brown) -1- to Oxygen Sensor (O2S) after Three Way Catalytic Converter (TWC) -G130-.

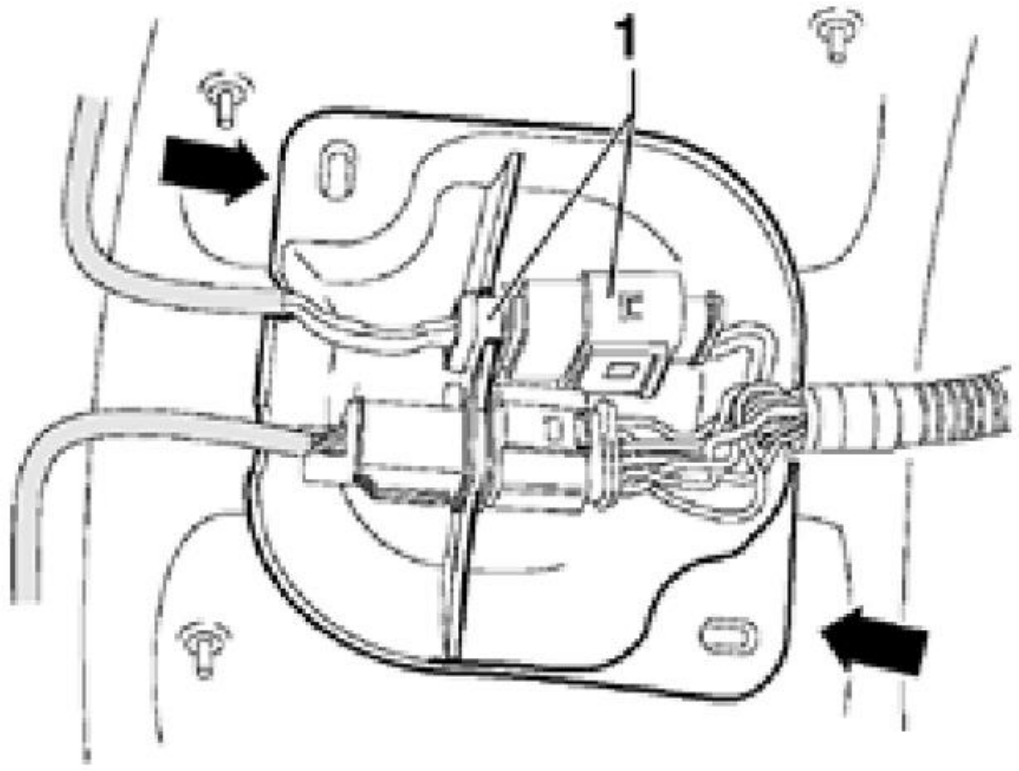


Fig. 115: Separating 4-Pin Connector (Black/Brown) -1- To HO2S -G130- After TWC
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Connect multimeter with auxiliary cables from VAG 1594 to measure voltage at terminals 3 + 4 (connector to Motronic control module).

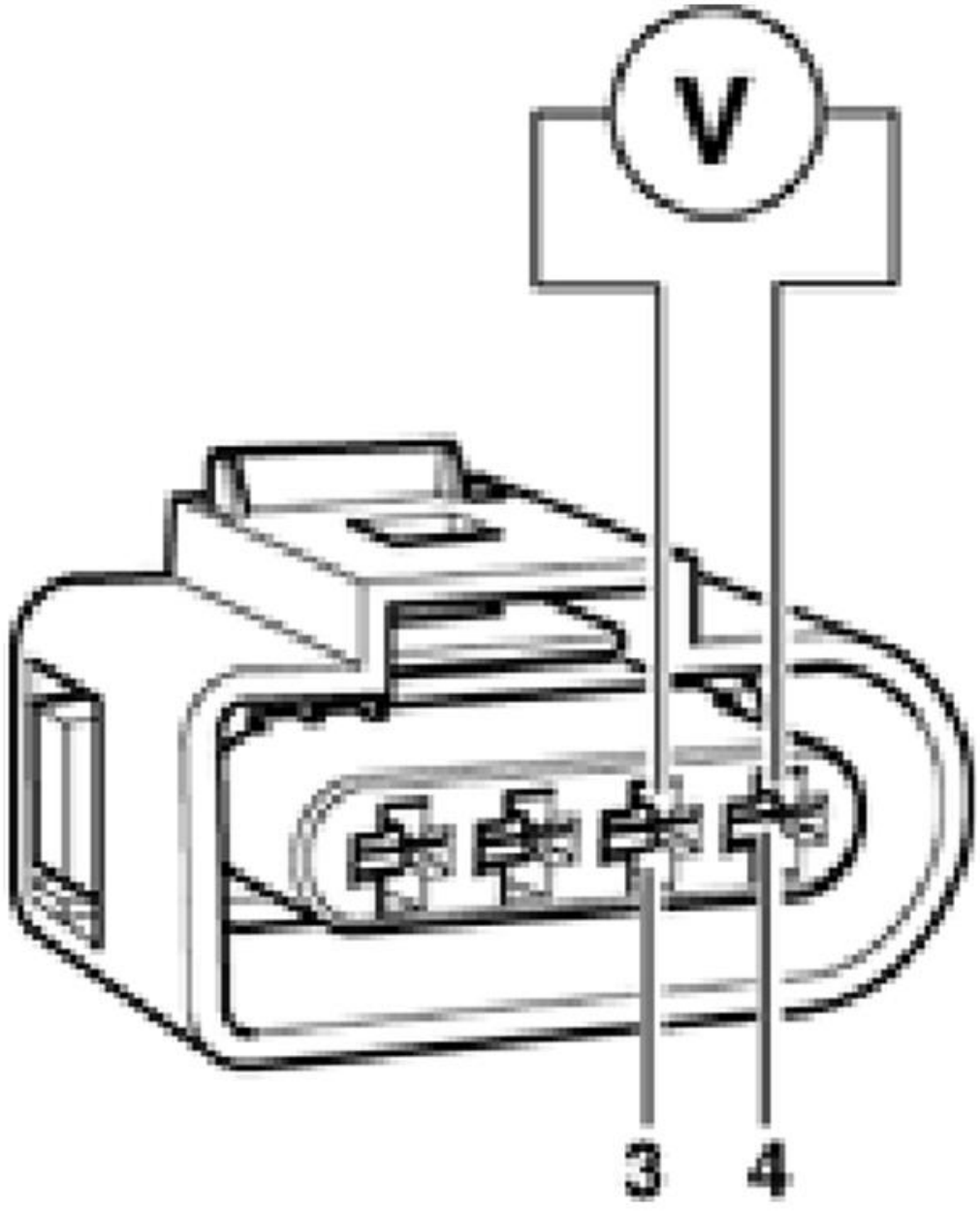


Fig. 116: Measuring Voltage At Terminals 3 And 4 On HO2S -G130- Harness Connector Terminals
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Start engine and measure basic voltage.

  Specification: 0.400 to 0.500 V

- Switch off ignition.

If the specification is not obtained:

- Check oxygen sensor wiring, see **CHECKING OXYGEN SENSOR WIRING, OXYGEN SENSOR 2** .

  If the specification is obtained:

- Replace Oxygen Sensor after Three Way Catalytic Converter (TWC) -G130-, see item 8 .
- Check DTC Memory, if necessary, repair any malfunctions and then Erase DTC Memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING** .
- Read readiness code, see **READINESS CODE, DISPLAYING** . If DTC memory has been erased or Motronic Engine Control Module (ECM) -J220- was disconnected from battery positive, readiness code must be generated again, see **READINESS CODE, GENERATING** .

Checking Oxygen Sensor wiring, oxygen sensor 2

- Remove inner plenum chamber cover, left:

  See **PLENUM CHAMBER INNER COVER, REMOVING AND INSTALLING**

- Connect VAG 1598/31 test box to control module wiring harness. Motronic Engine Control Module (ECM) -J220- is not connected by this action.

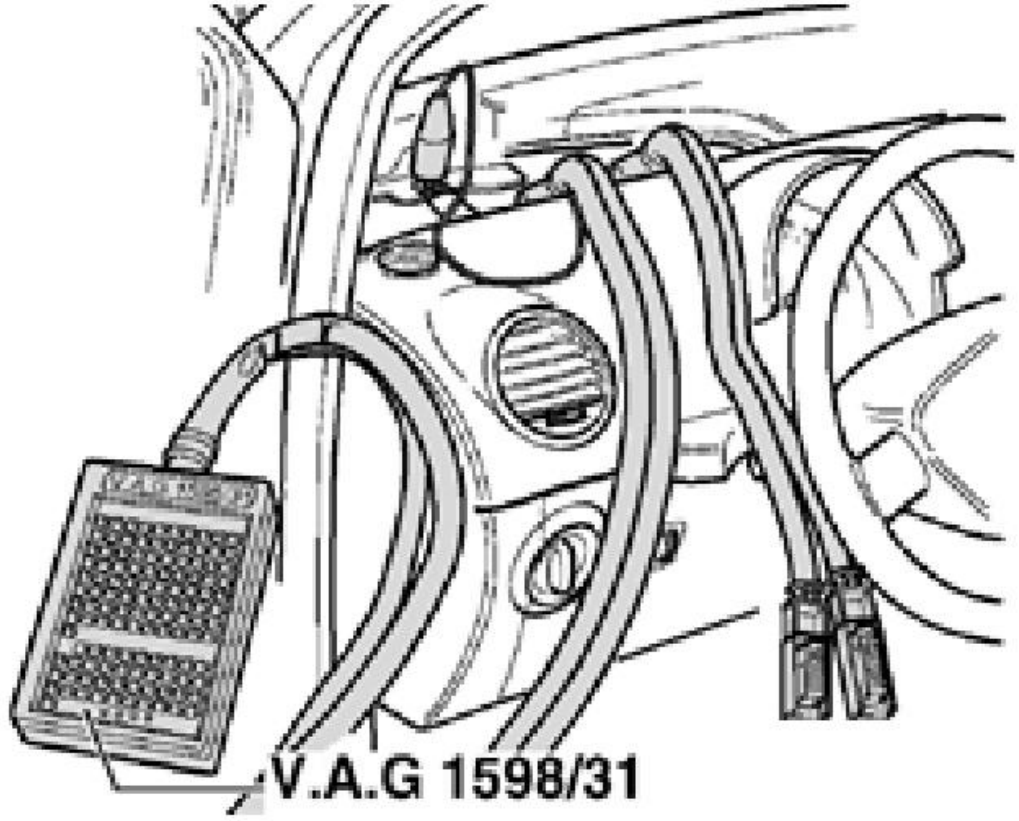


Fig. 117: Connecting VAG 1598/31 Test Box To Control Module Wiring Harness
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check wiring for open circuit between test box and 4 -pin connector to Motronic control module using Electrical Wiring Diagram.
  - terminal 3 + socket 68
  - terminal 4 + socket 69

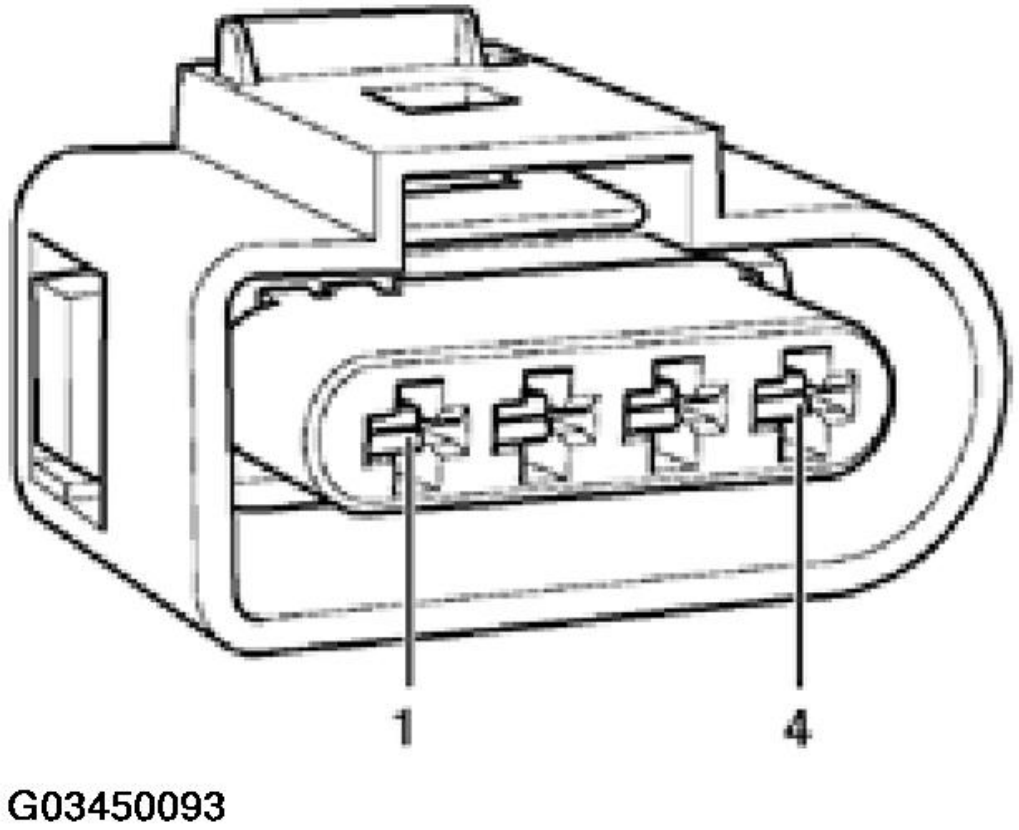


Fig. 118: Identifying HO2S -G130- Harness Connector Terminals
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Wire resistance: Max. 1.5 ohm

- Check wiring at connector terminals 3 + 4 for short circuit to terminals 1 + 2 using Electrical Wiring Diagram.
  - terminal 4 and socket 68

Specification: INFINITY ohm

If no wiring malfunction is found:

- Replace Motronic Engine Control Module (ECM) -J220-, see **MOTRONIC ENGINE CONTROL MODULE (ECM) - J220-, REPLACING** .

Oxygen sensor aging, oxygen sensor before Three Way Catalytic Converter (TWC), checking

Special tools, test equipment and auxiliary items

- VAG 1551 scan tool or VAG 1552 mobile scan tool with VAG 1551/3B cable
- VAG 1788/10 RPM adjuster

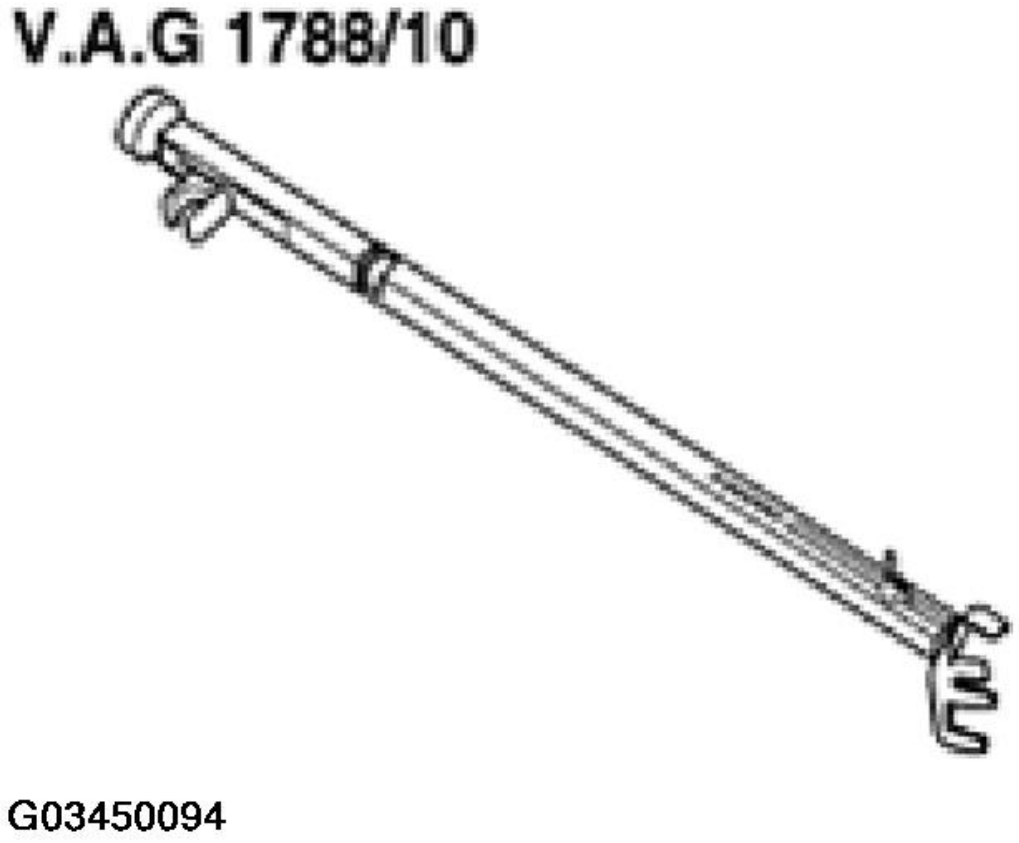


Fig. 119: Identifying Special Tool
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Test conditions

- Engine Coolant Temperature (ECT) must be at least 80 °C, see display group 04, display zone 3

Functional check

- Connect VAG 1551 scan tool (or VAG 1552). Start engine and select "Address word" 01 of Motronic Engine Control Module (ECM) -J220-. Engine must be running at idle speed. Connecting scan tool and selecting Motronic Engine Control Module (ECM) - J220-, see **VAG 1551, CONNECTING AND**

SELECTING MOTRONIC ENGINE CONTROL MODULE (ECM) -J220- .

Indicated on display

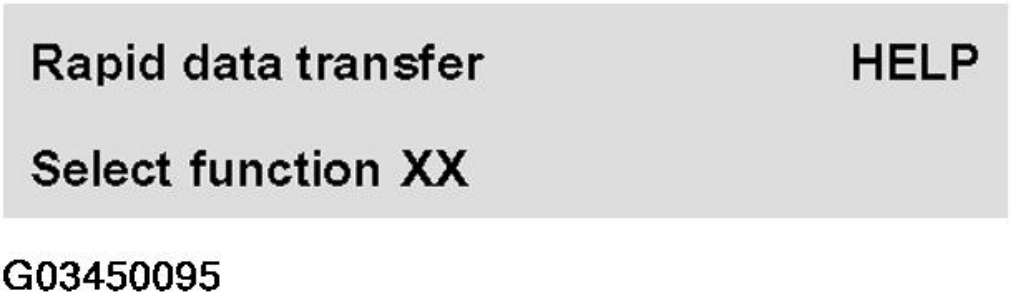


Fig. 120: Identifying Scan Tool Display - Checking Aging, HO2S Before TWC (1 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0- and -4- for function "Basic Setting" and confirm entry with -Q- button.

  Indicated on display

Fig. 121: Identifying Scan Tool Display - Checking Aging, HO2S Before TWC (2 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0-, -3- and -4- for "Display group number 34" and confirm entry with -Q- button.

Indicated on display (1 to 4 - Display zones)

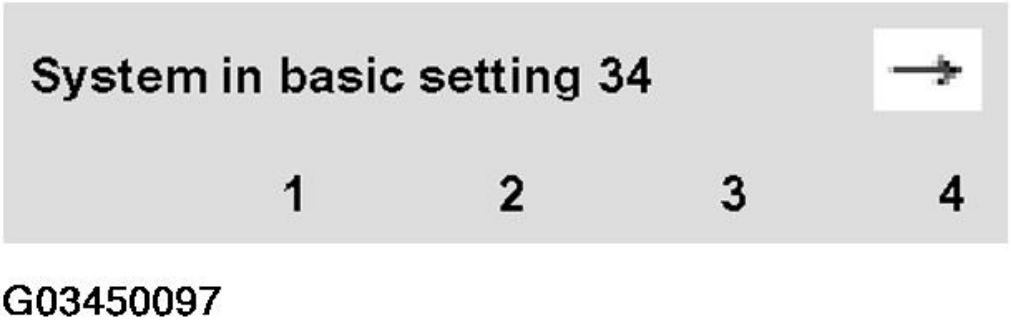


Fig. 122: Identifying Scan Tool Display - Checking Aging, HO2S Before TWC (3 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Adjust RPMs with VAG1788/10 RPM adjuster to 1800 to 2200RPM.
- Check specifications in display zones 1 to 4.
- Maintain engine speed at 1800...2200 rpm until display in display zone 4 jumps from "Test OFF" to "Test ON". Three Way Catalytic Converter (TWC) temperature in display zone 2 must be 350 to 500 °C
- Continue to maintain speed at 1800...2200 rpm until specification "B1-S1 OK" appears in display zone 4.

OXYGEN SENSOR CONTROL SPECIFICATION

	Display zones			
	1	**2**	**3**	**4**
Display group 34: Oxygen sensor aging diagnostic Bank 1 (sensor dynamics)				
Display	xxxx RPM	xxx.x °C	xx.xx	**Test OFF/Test ON B1-S1 OK/B1-S1 n.OK**
Indicated	Engine speed (in steps of 40)	Three Way Catalytic Converter (TWC) temperature	Sensor dynamics Bank 1 oxygen sensor 1	Diagnostic condition and diagnostic result
Working range	0 to 6800 RPM	-	0.00 to 1.99	-
Specifications	1800 to 2200 RPM	350 to 500 °C	> 0.50	**B1-S1 OK.**
	-	-	If the specifications are not obtained, see **OXYGEN SENSOR AGING, OXYGEN SENSOR AFTER THREE WAY**	

If the specifications are obtained:

- Press --> button.
- Remove engine speed adjuster VAG 1788/10 from accelerator pedal.
- Press buttons -0- and -6- for function "End output" and confirm entry with -Q- button.
- Switch off ignition.

Continuation

If the specifications are not obtained:

- Remove engine speed adjuster VAG 1788/10 from accelerator pedal.
- Road test vehicle to free oxygen sensor of possible contaminates and repeat test.

Observe the valid safety precautions when carrying out a road test, see **SAFETY PRECAUTIONS** .

If the specifications are again not obtained:

- Replace oxygen sensor before Three Way Catalytic Converter (TWC) -G39-, see item 10 .
- Check DTC Memory, if necessary, repair any malfunctions and then Erase DTC Memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING** .
- Read readiness code, see **READINESS CODE, DISPLAYING** . If DTC memory has been erased or Motronic Engine Control Module (ECM) -J220- was disconnected from battery positive, readiness code must be generated again, see **READINESS CODE, GENERATING** .

Oxygen sensor aging, oxygen sensor after Three Way Catalytic Converter (TWC), checking

Special tools, test equipment and auxiliary items

- VAG 1551 scan tool (or VAG 1552 mobile scan tool) with VAG 1551/3B cable
- VAG 1788/10 RPM adjuster

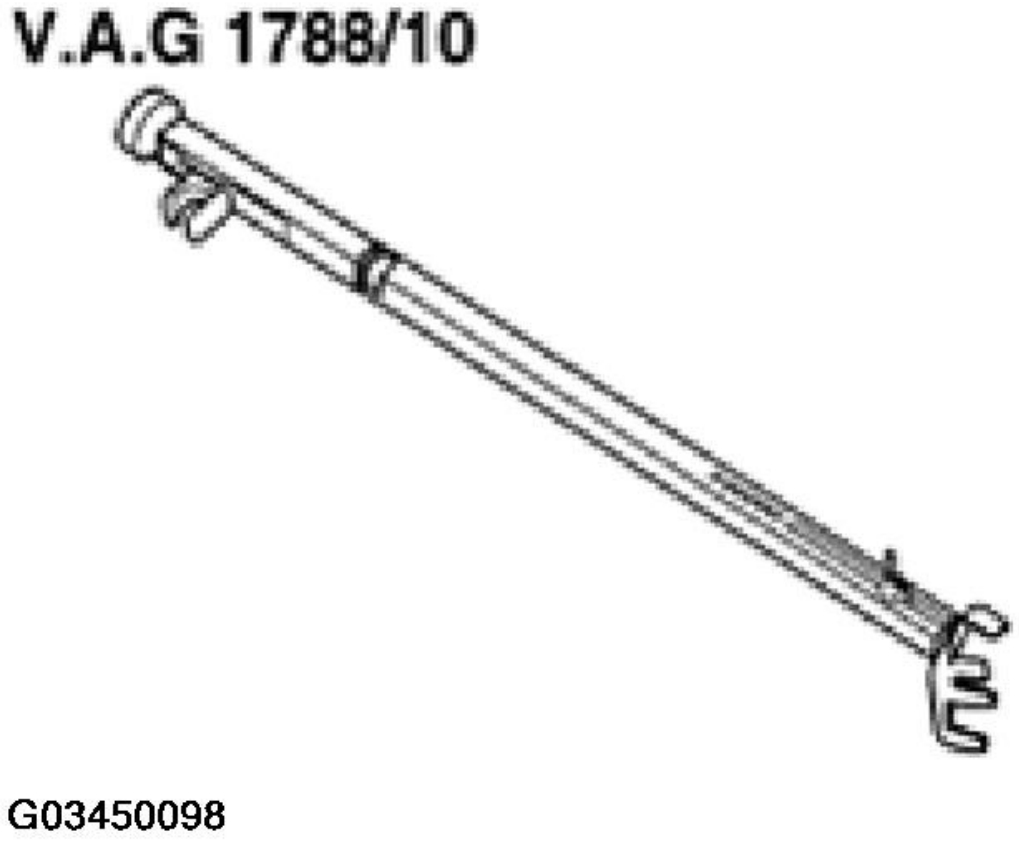


Fig. 123: Identifying Special Tool
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Test conditions

- Engine Coolant Temperature (ECT) must be at least 80 °C, see display group 04, display zone 3

Functional check

- Connect VAG 1551 scan tool ((VAG 1552). Start engine and select "Address word" 01 of Motronic Engine Control Module (ECM) -J220-. Engine must be running at idle speed. Connecting scan tool and selecting Motronic Engine Control Module (ECM) -J220-, see **VAG 1551, CONNECTING AND SELECTING MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-** .

  Indicated on display

G03450099

Fig. 124: Identifying Scan Tool Display - Checking Aging, HO2S After TWC (1 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0- and -4- for function "Basic Setting" and confirm entry with -Q- button.

  Indicated on display

G03450100

Fig. 125: Identifying Scan Tool Display - Checking Aging, HO2S After TWC (2 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0-, -4- and -3- for "Display group number 43" and confirm entry with -Q- button.

  Indicated on display (1 to 4 - Display zones)

G03450101

Fig. 126: Identifying Scan Tool Display - Checking Aging, HO2S After TWC (3 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Adjust RPMs with VAG 1788/10 RPM adjuster to 1800 to 2200 RPM.
- Check specifications in display zones 1 to 4.
- Maintain engine speed at 1800...2200 rpm until display in display zone 4 jumps from "Test OFF" to "Test ON". Three Way Catalytic Converter (TWC) temperature in display zone 2 must be at least 300 °C
- Continue to maintain speed at 1800...2200 rpm until specification "B1-S2 OK" appears in display zone 4.

DISPLAY GROUP 43: OXYGEN SENSOR DIAGNOSTIC AFTER THREE WAY CATALYTIC CONVERTER (TWC) (AGING CHECK)

	Display zones			
	1	**2**	**3**	**4**
Display group 43: oxygen sensor diagnostic after Three Way Catalytic Converter (TWC) (aging check)				
Display	xxxx RPM	xxx.x °C	x.xxx V	**Test OFF/Test ON B1-S2 OK/B1-S2 n.OK**
Indicated	Engine speed (in steps of 40)	Three Way Catalytic Converter (TWC) temperature	Diagnostic condition and diagnostic result	
Working range	0 to 6800 RPM	-	-	-
Specifications	1800 to 2200 RPM	>300 °C	0.100 to 0.900	**B1-S2 OK.**
	-	-	If the specifications are not obtained, see **Functional check** , Continuation	

If the specifications are obtained:

- Press --> button.
- Remove engine speed adjuster VAG 1788/10 from accelerator pedal.
- Press buttons -0- and -6- for function "End output" and confirm entry with -Q- button.
- Switch off ignition.

Continuation

If the specifications are not obtained:

- Remove engine speed adjuster VAG 1788/10 from accelerator pedal.
- Road test vehicle to free oxygen sensor of possible contaminates and repeat test.

Observe the valid safety precautions when road testing, see **SAFETY PRECAUTIONS** .

If the specifications are again not obtained:

- Replace oxygen sensor after Three Way Catalytic Converter (TWC) -G130-.
- Check DTC Memory, if necessary, repair any malfunctions and then Erase DTC Memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING** .
- Read readiness code, see **READINESS CODE, DISPLAYING** . If DTC memory has been erased or Motronic Engine Control Module (ECM) -J220- was disconnected from battery positive, readiness code must be generated again, see **READINESS CODE, GENERATING** .

Operational readiness of oxygen sensor after Three Way Catalytic Converter (TWC), checking

Function

To test the operational readiness of the oxygen sensor after Three Way Catalytic Converter (TWC), the fuel/air mixture is enriched while the oxygen sensor voltage is observed. The oxygen sensor voltage must rise.

Special tools, test equipment and auxiliary items

- VAG 1551 scan tool (or VAG 1552 mobile scan tool) with VAG 1551/3B cable

Test conditions

- Engine Coolant Temperature (ECT) must be at least 80 C, display group 04, display zone 3.

Functional check

- Connect VAG 1551 scan tool ((VAG 1552). Start engine and select "Address word" 01 of Motronic Engine Control Module (ECM) -J220-. Engine must be running at idle speed. Connecting scan tool and selecting Motronic Engine Control Module (ECM) -J220-, see **VAG 1551, CONNECTING AND SELECTING MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-** .

Indicated on display:

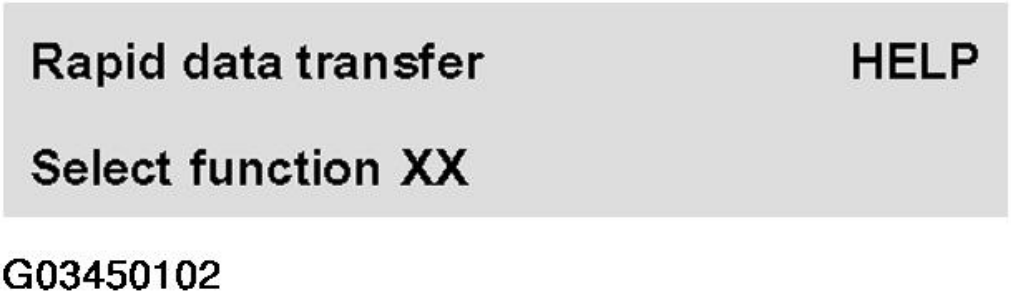


Fig. 127: Identifying Scan Tool Display - Checking Operational Readiness, HO2S After TWC (1 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0- and -4- for function "Introduction of basic setting" and confirm entry with -Q- button.

  Indicated on display:

Fig. 128: Identifying Scan Tool Display - Checking Operational Readiness, HO2S After TWC (2 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0-, -3- and -6- for "Display group number 36" and confirm entry with -Q- button.

Indicated on display: (1...2 - Display zones)

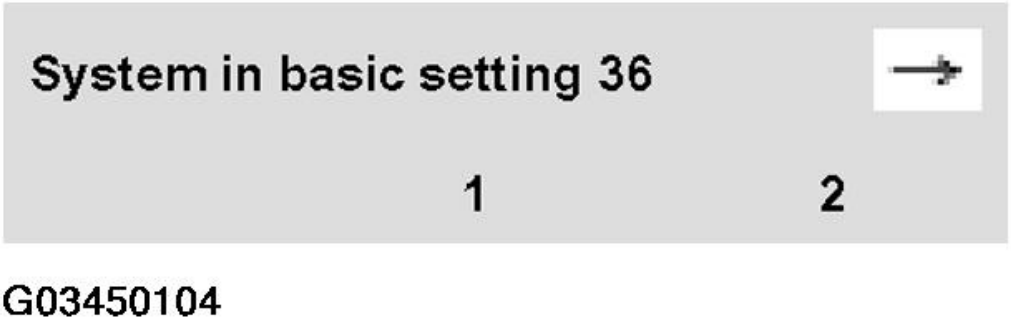


Fig. 129: Identifying Scan Tool Display - Checking Operational Readiness, HO2S After TWC (3 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Allow engine to run at idle until readout in display zone 2 jumps from "Test OFF" to "Test ON".
- Observe oxygen sensor voltage in display zone 1. Value must rise.
- Allow engine to continue to run at idle until specified value "B1 -S2 OK" appears in display zone.

If the specifications are obtained:

- Press --> button.
- Press buttons -0- and -6- for function "End output" and confirm entry with -Q- button.
- Switch off ignition.

If the specifications are not obtained:

- Road test vehicle to free oxygen sensor of possible contaminates and repeat test.

Observe the valid safety precautions when road testing, see **SAFETY PRECAUTIONS** .

If the specifications are again not obtained:

- Check basic voltage, see **CHECKING BASIC VOLTAGE FOR OXYGEN SENSOR 2**

Engine operating mode, checking

NOTE: Checks whether Motronic Engine Control Module (ECM) -J220- recognizes the

engine operating modes idling, overrun, part throttle, enrichment, full throttle.

Special tools, test equipment and auxiliary items

- VAG 1551 scan tool (or VAG 1552 mobile scan tool) with VAG 1551/3B cable

Test conditions

- Engine Coolant Temperature (ECT) must be at least 80 °C display group 04, display zone 3

Test sequence

- Connect VAG 1551 scan tool ((VAG 1552). Start engine and select "Address word" 01 of Motronic Engine Control Module (ECM) -J220-. Engine must be running at idle speed. Connecting scan tool and selecting Motronic Engine Control Module (ECM) -J220-, see **VAG 1551, CONNECTING AND SELECTING MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-** .

  Indicated on display

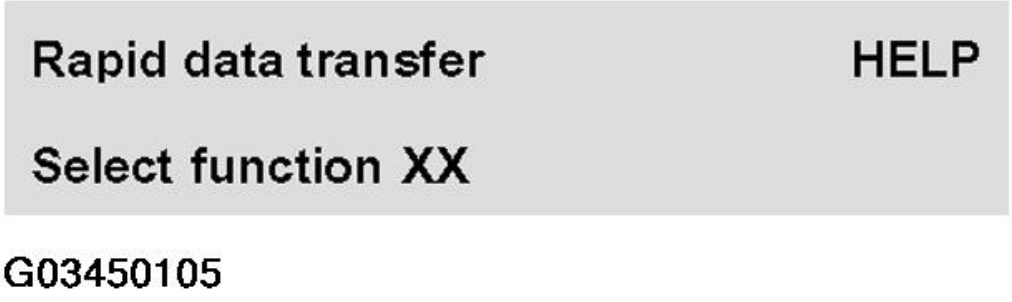


Fig. 130: Identifying Scan Tool Display - Engine Operating Mode, Checking (1 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0- and -8- for function "Read measuring value block" and confirm entry with -Q- button.

  Indicated on display

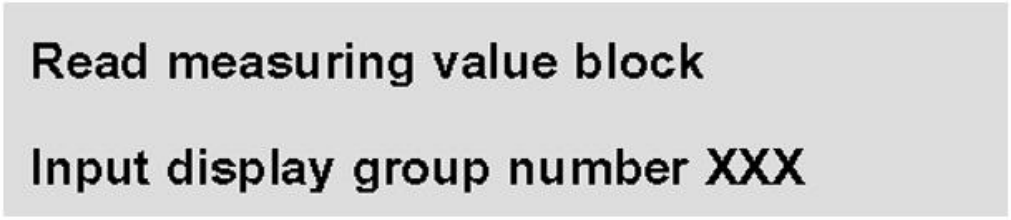


Fig. 131: Identifying Scan Tool Display - Engine Operating Mode, Checking (2 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0-, -0- and -5- for "Display group number 5" and confirm entry with -Q- button.

  Indicated on display (1 to 4 - Display zones)

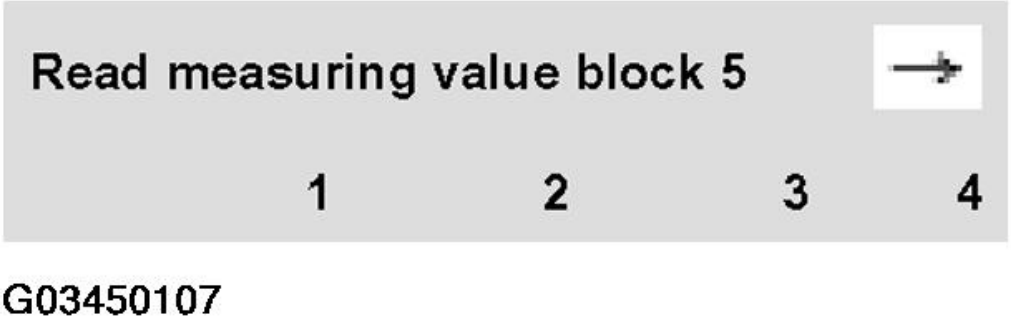


Fig. 132: Identifying Scan Tool Display - Engine Operating Mode, Checking (3 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check whether control module recognizes operating mode (display zone 4):

Idling:

As long as the engine is running at idle speed "idling" must be displayed

- Display: Idling

Overrun mode:

- Increase engine speed to above 3000 RPM.
- Close throttle abruptly.
- As long as the engine speed is above 1400 RPM "overrun" must be displayed

- Display: Overrun

NOTE:

- **A test drive may have to be performed to show "Overrun" in display.**
- **Below 1400 RPM idling speed will be recognized.**

Observe the valid safety precautions when carrying out a road test, see **SAFETY PRECAUTIONS** .

Part throttle:

- Rev up evenly.

As long as the engine is being revved up evenly, "part throttle" must be displayed

- Display: Part throttle

Enrichment:

- Floor accelerator pedal (onto throttle valve stop).

  Acceleration "enrichment" must be displayed briefly

- Display: Enrichment

Full throttle:

- Floor accelerator pedal (onto throttle valve stop).

  "Full throttle" must be displayed briefly

  - Display: Full throttle

  NOTE: **A test drive may have to be performed to show "Full throttle" in the display.**

  Observe the valid safety precautions when carrying out a road test, see **SAFETY PRECAUTIONS** .

- Press --> button.

- Press buttons -0- and -6- for function "End output" and confirm entry with -Q- button.

  If the specifications are not obtained:

- Check DTC Memory, if necessary, repair any malfunctions and then Erase DTC Memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING** .
- Check accelerator mechanism for ease of operation.
- Check throttle valve potentiometer, see **THROTTLE VALVE CONTROL MODULE -J338-, CHECKING** .
- Read readiness code, see **READINESS CODE, DISPLAYING** . If DTC memory has been erased or Motronic Engine Control Module (ECM) -J220- was disconnected from battery positive, readiness code must be generated again, see **READINESS CODE, GENERATING** .

MOTRONIC ENGINE CONTROL MODULE (ECM)

Motronic Engine Control Module (ECM) - J220- voltage supply, checking

Special tools, test equipment and auxiliary items

- VAG 1551 scan tool or VAG 1552 mobile scan tool with VAG 1551/3B cable
- VAG 1598/31 test box
- VAG 1526 A or Fluke 83 multimeter
- VAG 1594 adapter set
- Electrical Wiring Diagram

Test conditions

- All fuses must be OK. Fuse holder is located behind access panel at far left end of dash.

G03450108

Fig. 133: Locating Fuses
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Battery voltage must be at least 11.5 V
- All electrical accessories, e.g. lights and rear window defroster must be switched off
- If the vehicle is equipped with air conditioning, it must be turned off
- Selector lever must be in position "P" or "N" on vehicles with an automatic transmission
- Alternator OK.

Test sequence

- Connect VAG 1551 scan tool ((VAG 1552). Start engine and select "Address word" 01 of Motronic

Engine Control Module (ECM) -J220-. Engine must be running at idle speed. Connecting scan tool and selecting Motronic Engine Control Module (ECM) -J220-, see **VAG 1551, CONNECTING AND SELECTING MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-** .

Indicated on display

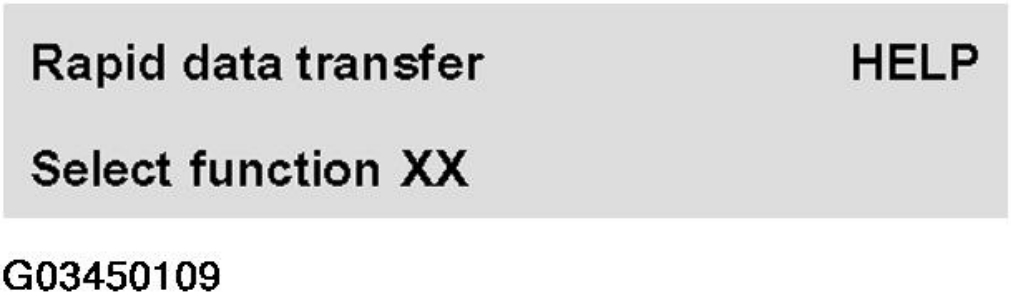


Fig. 134: Identifying Scan Tool Display - ECM Voltage Supply, Checking (1 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0- and -8- for function "Read measuring value block" and confirm entry with -Q- button.

  Indicated on display

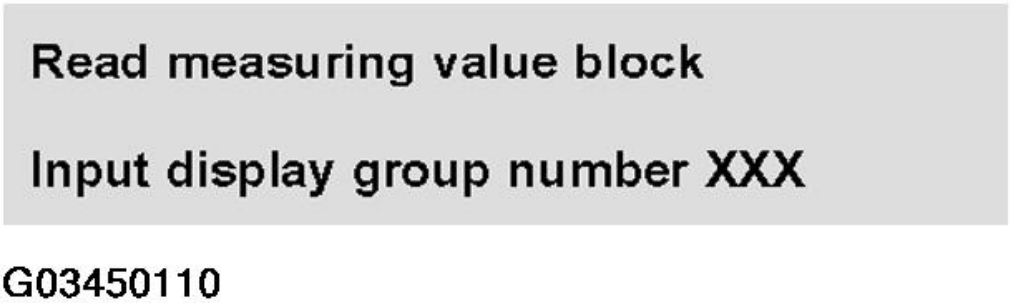


Fig. 135: Identifying Scan Tool Display - ECM Voltage Supply, Checking (2 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0-, -0- and -4- for "Display group number 4" and confirm entry with -Q- button.

  Indicated on display (1 to 4 - Display zones)

G03450111

Fig. 136: Identifying Scan Tool Display - ECM Voltage Supply, Checking (3 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Read supply voltage for Motronic Engine Control Module (ECM) - J220- in display zone 2:

  Specification: At least 11.5 V

DISPLAY GROUP 4: GENERAL ENGINE DATA

	Display zones			
	1	**2**	**3**	**4**
Display group 4: General engine data				
Display	xxxx RPM	xx.xxx V	xxx.x °C	xxx.x °C
Indicated	Engine speed (in steps of 40)	Supply voltage for Motronic Engine Control Module (ECM) -J220-	Engine Coolant Temperature (ECT)	Intake air temperature
Working range	0 to 6800 RPM	0.000 to 16.500 V	-48.0 to 143.0 °C	-48.0 to 143.0 °C
Specification	760 to 810 RPM(1) 700 to 750 RPM(2)	>11.5 V	80.0 to 115.0 °C	-
	-	If the specification is not obtained, see **CHECKING VOLTAGE SUPPLY TERMINAL 30** , Evaluating display group 4	-	-

(1) Engine idling at normal operating temperature for manual transmission

(2) Engine idling at normal operating temperature for automatic transmission

- Press --> button.
- Press buttons -0- and -6- for function "End output" and confirm entry with -Q- button.
- Switch off ignition.

Evaluating display group 4, display zone 2 - Control module voltage supply

EVALUATING DISPLAY GROUP 4, DISPLAY ZONE 2 - CONTROL MODULE VOLTAGE SUPPLY

Appears on display	Possible cause	Corrective action
Less than 12.0 V	• Alternator malfunctioning, battery heavily discharged • Battery heavily loaded shortly after starting due to high charging current and current consumers • Transfer resistance in the current supply or the Motronic Engine Control Module (ECM) -J220- Ground (GND) connection • Current draw when ignition is off	• Check alternator and battery voltage, charge battery • Increase revs (RPM) slightly for a few minutes and switch off current consumers • Check voltage supply terminal 30, see **CHECKING VOLTAGE SUPPLY TERMINAL 30** • - Check voltage supply terminal 15, see **CHECKING VOLTAGE SUPPLY TERMINAL 15** • Eliminate current draw
More than 14.5 V	• Voltage regulator on alternator malfunctioning • Excess voltage due to jump starting or quick charging unit	• Check voltage regulator, replace if necessary • Check DTC Memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING**

If the specification is not obtained:

- Remove inner plenum chamber cover, left:

  See **PLENUM CHAMBER INNER COVER, REMOVING AND INSTALLING**

- ConnectVAG 1598/31 test box to control module wiring harness. Motronic Engine Control Module (ECM) -J220- is not connected by this action.

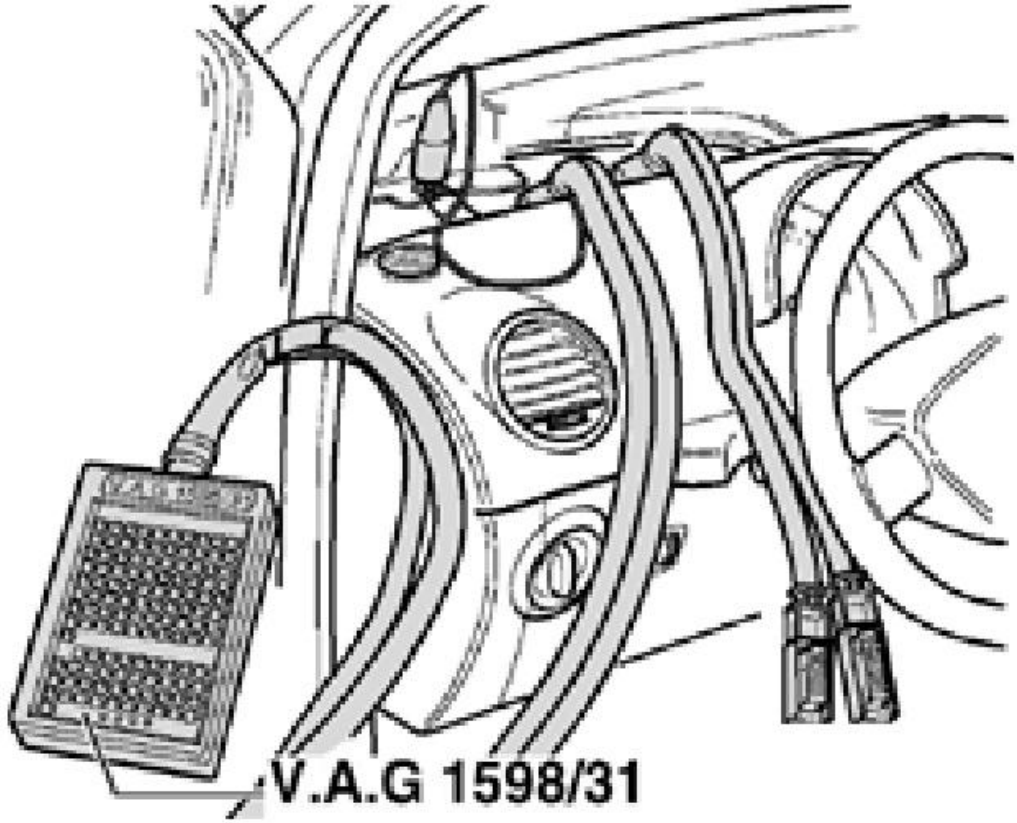


Fig. 137: Connecting VAGXS 1598/31 Test Box To Control Module Wiring Harness
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Checking voltage supply terminal 30

- Measure supply voltage between test box sockets 1 + 62 using multimeter and adapter cables from VAG 1594:

  Specification: at least 11.5 V

  If the specification is not obtained:

- Check wiring connections to relay plate according to Electrical Wiring Diagram.
- Check DTC Memory, if necessary, repair any malfunctions and then Erase DTC Memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND**

ERASING .

- Read readiness code, see **READINESS CODE, DISPLAYING** . If DTC memory has been erased or Motronic Engine Control Module (ECM) -J220- was disconnected from battery positive, readiness code must be generated again, see **READINESS CODE, GENERATING** .

Checking voltage supply terminal 15

- Measure supply voltage between test box sockets 2 + 3 using multimeter and cables from VAG 1594.
- Switch on ignition.

Specification: min. 11.5 V

If the specification is not obtained:

- Check wiring connections to relay plate according to Electrical Wiring Diagram.
- Check DTC Memory, if necessary, repair any malfunctions and then Erase DTC Memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING** .
- Read readiness code, see **READINESS CODE, DISPLAYING** . If DTC memory has been erased or Motronic Engine Control Module (ECM) -J220- was disconnected from battery positive, readiness code must be generated again, see **READINESS CODE, GENERATING** .

Procedure after correcting voltage supply open circuit

All values learned by the Motronic Engine Control Module (ECM) -J220- and the basic setting values as well as the readiness code will be erased if the voltage supply is interrupted. Therefore, depending upon the vehicle mileage it can lead to serious engine running problems.

Special tools, test equipment and auxiliary items

- VAG 1551 scan tool or VAG 1552 mobile scan tool with VAG 1551/3B cable

Work sequence

Perform the following operations after voltage supply open circuit:

- Switch ignition on for at least 10 seconds.
- Switch off ignition.
- Adapt Motronic Engine Control Module (ECM) - J220- to Throttle Valve Control Module -J338-, see **MOTRONIC ENGINE CONTROL MODULE (ECM) - J220- TO THROTTLE VALVE CONTROL MODULE - J338-, ADAPTING** .
- Perform idle check, see **FUNCTIONS, CHECKING** .
- Generate readiness code, see **READINESS CODE, GENERATING** .

NOTE: During idling check the EVAP canister purge regulator valve and the air

conditioner are switched off and the oxygen sensor control learning procedure is initiated.

- Perform a longer test drive until poor driving characteristics are eliminated.

  Observe the valid safety precautions when road testing, see **SAFETY PRECAUTIONS** .

- During the road test the following operating conditions must be fulfilled:

- Engine Coolant Temperature (ECT) must exceed 80 °C

  When the temperature is reached, the operating conditions:

- Idling
- Part throttle
- Full throttle
- Overrun

Must be obtained several times.

- At full throttle the speed must exceed 3500 RPM

Motronic Engine Control Module (ECM) - J220-, replacing

Special tools, test equipment and auxiliary items

- VAG 1551 scan tool with VAG 1551/3B cable

Removing

- First print out control module identification and thereby previous control module coding as follows:
- Connect VAG 1551 scan tool ((VAG 1552). Switch ignition on and select Motronic Engine Control Module (ECM) -J220- with "Address word" 01. Connecting scan tool and selecting Motronic Engine Control Module (ECM) -J220-, see **VAG 1551, CONNECTING AND SELECTING MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-** .

  The control module identification and coding are indicated on the display, e.g.:

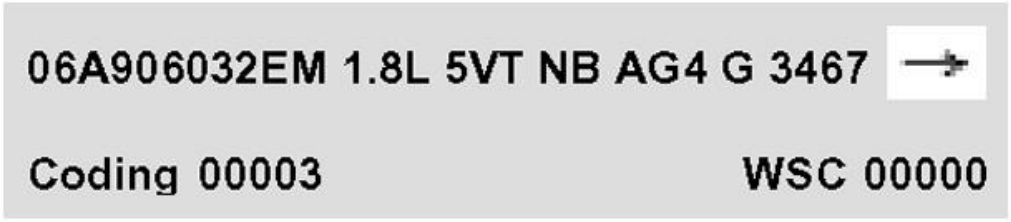


Fig. 138: Identifying Scan Tool Display - ECM, Replacing (1 Of 2)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Print out control module identification by pressing scan tool print button.
- Press --> button.
- Press buttons -0- and -6- for function "End output" and confirm entry with -Q- button.

Indicated on display:

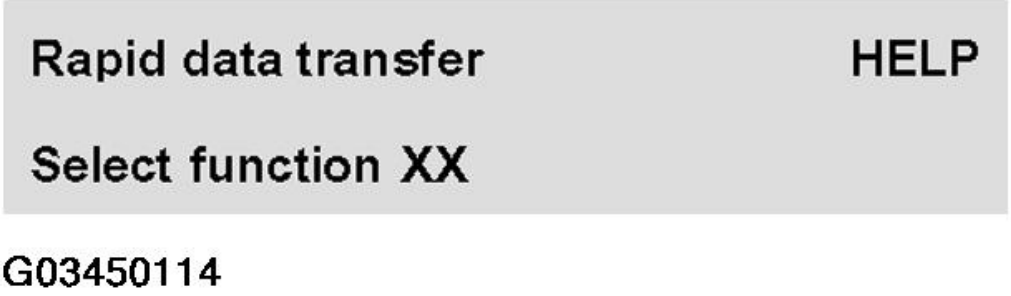


Fig. 139: Identifying Scan Tool Display - ECM, Replacing (2 Of 2)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Switch off ignition.
- Remove inner plenum chamber cover, left:

  See **PLENUM CHAMBER INNER COVER, REMOVING AND INSTALLING**

- Press retaining tab -arrow- to left and pull control module out.

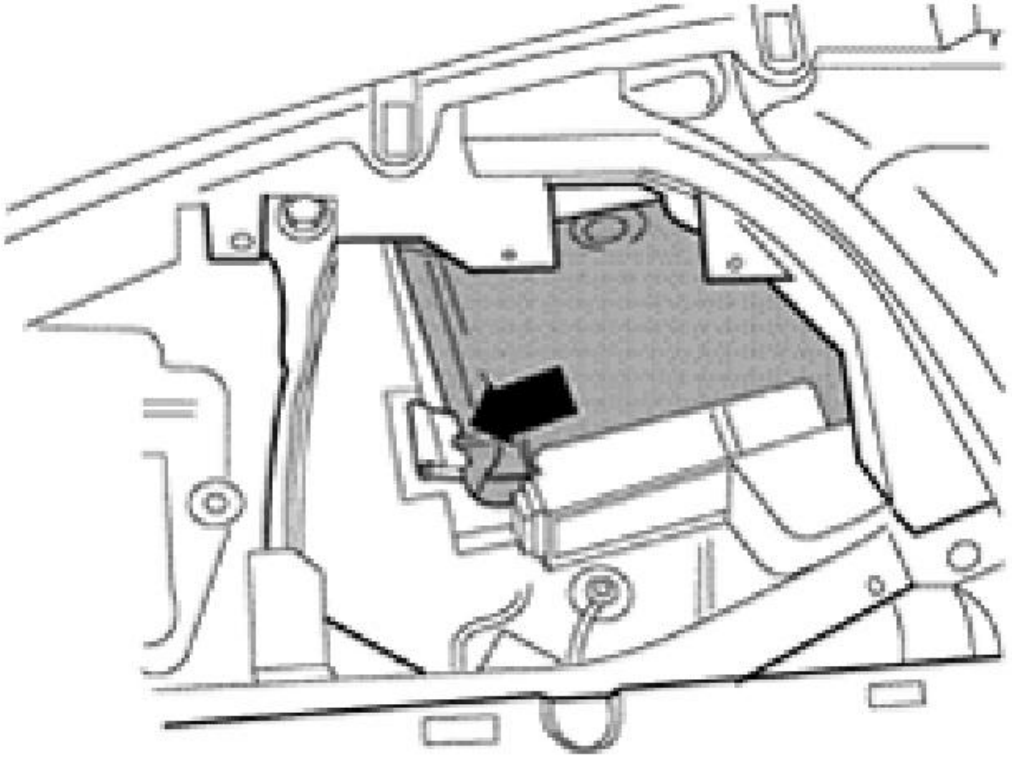


Fig. 140: Removing Engine Control Module
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Release connector from control module and disconnect it.
- Remove control module.

Installing

- Install control module connector and lock.
- Place new control module into retaining frame.
- Check DTC Memory, if necessary, repair any malfunctions and then Erase DTC Memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING** .
- Adapt new control module to immobilizer Repair Manual, Electrical Equipment On Board Diagnostic

(OBD), Repair Group 01.

- Adapt new control module to Throttle Valve Control Module - J338-, see **MOTRONIC ENGINE CONTROL MODULE (ECM) - J220- TO THROTTLE VALVE CONTROL MODULE - J338-, ADAPTING** .

- On vehicles with cruise control system: Check whether this function has been enabled (activated), see **VAG 1551, CONNECTING AND SELECTING MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-** . If "G" is not evident in control module identification, activate cruise control system.

Vehicles with automatic transmissions:

- Learning kick-down point, see **KICK-DOWN POSITION, LEARNING**
- Adapt control module for automatic transmission:

See **DIAGNOSIS - 01M**

Continued for all vehicles

- Perform idle check, see **FUNCTIONS, CHECKING** .
- Generate readiness code, see **READINESS CODE, GENERATING**

Motronic Engine Control Module (ECM) - J220- to Throttle Valve Control Module - J338-, adapting

The adaptation teaches the Motronic Engine Control Module (ECM) -J220- the various positions of the throttle unit when the ignition is switched on and the engine is not running. These positions are stored in the control module. The feedback of the throttle valve position is via both angle sensors for throttle valve drive.

Adapting sequence must be performed if:

- Voltage supply is interrupted
- Throttle Valve Control Module -J338- is removed and installed
- Throttle Valve Control Module -J338- is replaced
- If when installing another engine another Throttle Valve Control Module -J338- is installed
- Motronic Engine Control Module (ECM) -J220- is replaced.

NOTE: On vehicles with an automatic transmission, the transmission control module must also be adapted:

See **DIAGNOSIS - 01M**

Special tools, test equipment and auxiliary items

- VAG 1551 scan tool (or VAG 1552 mobile scan tool) with VAG 1551/3B cable

Test conditions

- No DTCs must be stored in DTC memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING**
- Battery voltage must be at least 11.5 V
- All electrical accessories, e.g. lights and rear window defroster, must be switched off
- The throttle valve must be at idling speed position (The accelerator must not be operated during the test).
- Throttle valve must not be dirty (carbonization).
- Engine Coolant Temperature (ECT) must be 5 to 95 °C display group 04, display zone 3.
- The cruise control system must be functioning correctly if installed.

Work sequence

- Connect VAG 1551 scan tool ((VAG 1552). Switch ignition on and select Motronic Engine Control Module (ECM) -J220- with "Address word" 01. Connecting scan tool and selecting Motronic Engine Control Module (ECM) -J220-, see **VAG 1551, CONNECTING AND SELECTING MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-** .

  Indicated on display

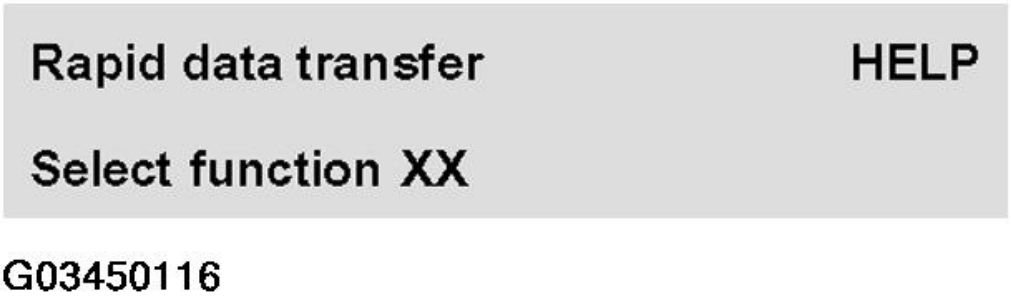


Fig. 141: Identifying Scan Tool Display - Adapting ECM To Throttle Valve Control Module (1 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0- and -4- for function "Basic Setting" and confirm entry with -Q- button.

  Indicated on display

Fig. 142: Identifying Scan Tool Display - Adapting ECM To Throttle Valve Control Module (2 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0-, -6- and -0- for "Display group number 60" and confirm entry with -Q- button.

  Indicated on display (1 to 4 - Display zones)

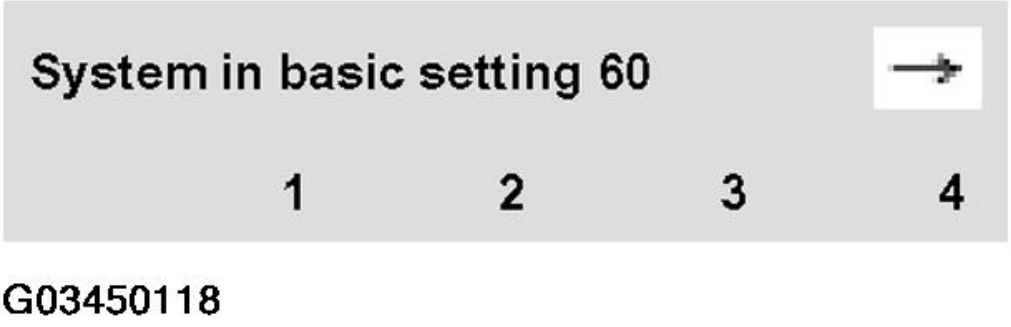


Fig. 143: Identifying Scan Tool Display - Adapting ECM To Throttle Valve Control Module (3 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

After pressing the -Q- button the throttle valve positioner is switched so that it is not supplied with voltage at start of test.

In this condition the throttle valve is pulled into an emergency running position by a mechanical spring in

the Throttle Valve Control Module -J338-. The values from both angle sensors in the emergency running position are stored by the ECM.

Thereafter the throttle valve is opened a predetermined value. If this value is achieved, the throttle valve is again switched so that it is not supplied with voltage. Now the mechanical spring must pull the throttle valve to the previously learned emergency running position within a predetermined time (spring test).

Then the throttle valve is closed by the throttle valve positioner and the values, which are supplied by the angle sensors in the Throttle Valve Control Module -J338- are stored by the Motronic Engine Control Module (ECM) -J220-.

If the Motronic Engine Control Module (ECM) - J220- switches the throttle valve positioner so that it is without voltage during normal operation, this is indicated by the increased and hunting idle speed. The engine reacts slowly to accelerator changes.

- Check specifications (display zones 1 to 4):

DISPLAY GROUP 60: ADAPTING THROTTLE VALVE CONTROL MODULE -J338-

	Display zones			
	1	**2**	**3**	**4**
Display group 60: Adapting Throttle Valve Control Module -J338-				
Display	xxx %	xxx %	x	ADP. runs ADP. OK. ERROR
Indicated	Throttle valve angle sensor 1 - G187-	Throttle valve angle sensor 2 - G188-	Learn step counter	Adaptation condition
Working range	0 to 100%	0 to 100%	0 to 8	-
Specification	10 to 88%	89 to 11%	Counter counts up to 8 during adaptation	ADP. runs
-		-	8	ADP. OK. (ERROR Appears after unsuccessful adaptation)
If the specification is not obtained, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING** or, see **THROTTLE VALVE CONTROL MODULE -J338-, CHECKING** .				

- Terminate engine basic setting at earliest after 30 seconds by pressing button.

Adapting has been performed successfully.

To store the values:

- Switch off ignition.

NOTE: **If the basic setting of the control module is interrupted, the cause could be one of the following:**

- **The test conditions were not fulfilled.**
- **Throttle valve cannot reach the mechanical idle speed stop because of contamination e.g. oil deposits.**
- **Throttle Valve Control Module is malfunctioning or there is a malfunction in the wiring, checking, see THROTTLE VALVE CONTROL MODULE -J338-, CHECKING .**

After an interruption a DTC is stored in DTC memory. When next switching on ignition the basic setting is automatically performed again.

- End engine basic setting by pressing button.
- Press buttons -0- and -6- for function "End output" and confirm entry with -Q- button.
- Switch off ignition.

Kick-down position, learning

Following replacement of the Motronic Engine Control Module (ECM) -J220- or the accelerator pedal, vehicles with automatic transmission must relearn the kick -down point.

Test conditions

- Ignition on, engine not running

Test sequence

- Connect scan tool VAG 1551 ((VAG 1552). Switch ignition on and select Motronic Engine Control Module (ECM) -J220- with "Address word" 01. (Connecting scan tool and selecting Motronic Engine Control Module (ECM) -J220-, see **VAG 1551, CONNECTING AND SELECTING MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-**).

  Indicated on display:

G03450119

Fig. 144: Identifying Scan Tool Display - Kick-Down Position, Learning (1 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0- and -4- for function "Introduction of basic setting" and confirm entry with -Q- button.

  Indicated on display:

G03450120

Fig. 145: Identifying Scan Tool Display - Kick-Down Position, Learning (2 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0-, -6- and -3- for "Display group number 63" and confirm with -Q- button.

  Indicated on display:

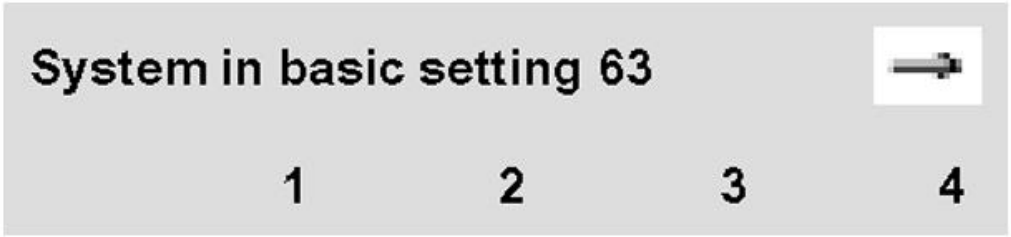


Fig. 146: Identifying Scan Tool Display - Kick-Down Position, Learning (3 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Observe display in display zones 3 and 4:

  Display: Operate kick down

- Press accelerator pedal beyond kick -down pressure point to floor.
- Hold pedal at this point for at least 2 seconds.
- Observe display in display zones 3 and 4:

  Specification: Kick Down ADP. runs then

  Specification: Kick Down ADP. OK

- Observe display in display zones 3 and 4:

  Display: Kick Down ERROR

- End engine basic setting by pressing the button.
- Press buttons -0- and -6- for function "End output" and confirm entry with -Q- button.
- Check Throttle Position (TP) sensor:

  See **THROTTLE POSITION (TP) SENSOR, CHECKING**

ADDITIONAL SIGNALS, CHECKING

Engine speed signal (RPM), checking

Special tools, test equipment and auxiliary items

- VAG 1551 scan tool or VAG 1552 mobile scan tool with VAG 1551/3B cable
- VAG 1598/31 test box
- VAG 1526 A or Fluke 83 multimeter
- VAG 1594 adapter set
- Electrical Wiring Diagram

Test conditions

- All fuses must be OK. Fuse holder is located behind access panel at far left end of dash.

Fig. 147: Locating Fuses
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Battery voltage must be at least 11.5 V
- Speedometer must be OK., checking speedometer:

  See **INSTRUMENTS**

- Selector lever must be in position "P" or "N" on vehicles with an automatic transmission

Test sequence

NOTE: To check the speed signal the vehicle must be driven and a second person is necessary.

WARNING: During a road test in an airbag-equipped vehicle, test equipment must always be fastened to and operated from the rear seat by a second technician.

- Connect VAG 1551 scan tool ((VAG 1552). Start engine and select "Address word" 01 of Motronic Engine Control Module (ECM) -J220-. Engine must be running at idle speed. Connecting scan tool and selecting Motronic Engine Control Module (ECM) -J220-, see **VAG 1551, CONNECTING AND SELECTING MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-** .

  Indicated on display

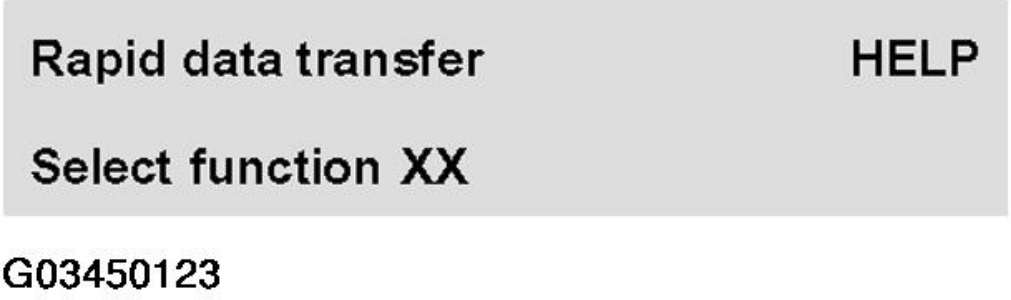


Fig. 148: Identifying Scan Tool Display - Engine Speed Signal (RPM), Checking (1 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0- and -8- for function "Read measuring value block" and confirm entry with -Q- button.

  Indicated on display

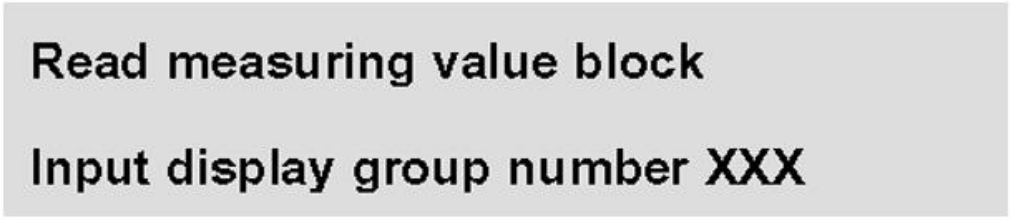


Fig. 149: Identifying Scan Tool Display - Engine Speed Signal (RPM), Checking (2 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0-, -0- and -5- for "Display group number 5" and confirm entry with -Q- button.

  Indicated on display (1 to 4 - Display zones)

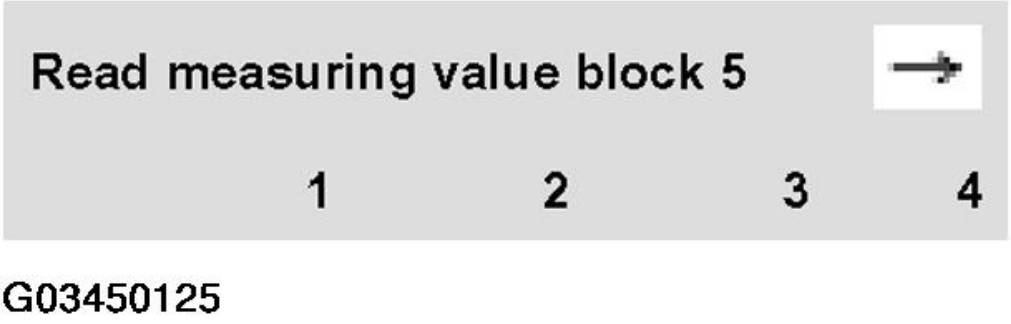


Fig. 150: Identifying Scan Tool Display - Engine Speed Signal (RPM), Checking (3 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Test drive vehicle with a 2nd person to observe display.

  Observe the valid safety precautions when carrying out a road test, see **SAFETY PRECAUTIONS** .

- Observe figure displayed in display zone 3:

Specification: approx. driven speed

DISPLAY GROUP 5: GENERAL ENGINE DATA

	Display zones			
	1	**2**	**3**	**4**
Display group 5: General engine data				
Display	xxxx RPM	xxx %	**xxx km/h**	Idling part load full load overrun enrichment
Indicated	Engine speed (in steps of 40)	Engine load	Vehicle speed	Operating mode
Working range	0 to 6800 RPM	0 to 175%	**0 to 260 km/h**	-
Specification	-	-	Approx. vehicle speed	-
	-	-	If no driving speed is displayed, see **SIGNAL FROM/TO AIR CONDITIONING, CHECKING** , Continued	

- Press --> button.
- Press buttons -0- and -6- for "End output" function and confirm input with -Q- button.
- Switch off ignition.

Continuation

If no speed is displayed:

- Remove inner plenum chamber cover, left:

  See **PLENUM CHAMBER INNER COVER, REMOVING AND INSTALLING**

- Connect VAG 1598/31 test box to control module wiring harness. Motronic Engine Control Module (ECM) -J220- is not connected by this action.

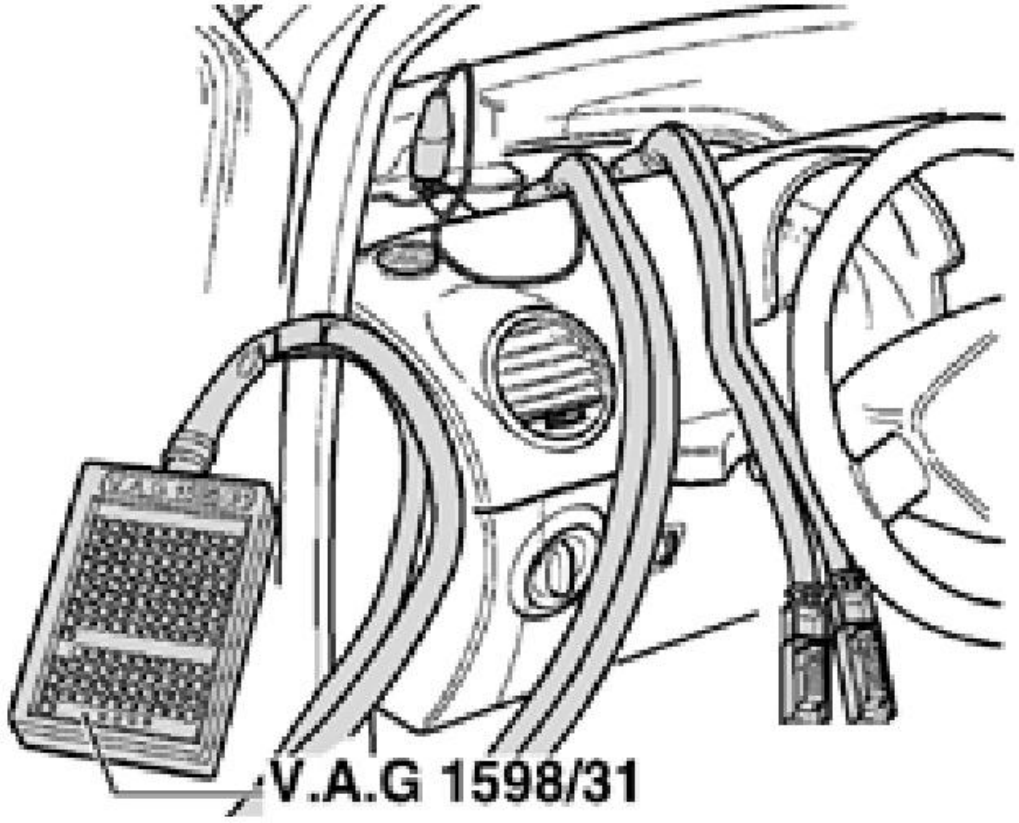


Fig. 151: Connecting VAG 1598/31 Test Box To Control Module Wiring Harness
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Connect multimeter to measure voltage between test box sockets 3 (terminal 15) + 54 (speed signal).
- Switch on ignition.
- Lift vehicle at front left.
- Rotate front wheel and observe voltage display.

Specification: between 0 and at least 4 Volt fluctuating

NOTE: If necessary, hold the front right wheel to prevent it from turning.

If the display does not fluctuate:

- Check wiring to speedometer/speedometer sensor.
- Check DTC Memory, if necessary, repair any malfunctions and then Erase DTC Memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING** .
- Read readiness code, see **READINESS CODE, DISPLAYING** . If DTC memory has been erased or Motronic Engine Control Module (ECM) -J220- was disconnected from battery positive, readiness code must be generated again, see **READINESS CODE, GENERATING** .

Signal from/to air conditioning, checking

Special tools, test equipment and auxiliary items

- VAG 1551 scan tool or VAG 1552 mobile scan tool with VAG 1551/3B cable
- VAG 1598/31 test box
- VAG 1526 A or Fluke 83 multimeter
- VAG 1594 adapter set
- Electrical Wiring Diagram

Test conditions

- All fuses must be OK. Fuse block is located behind access panel at far left end of dash.

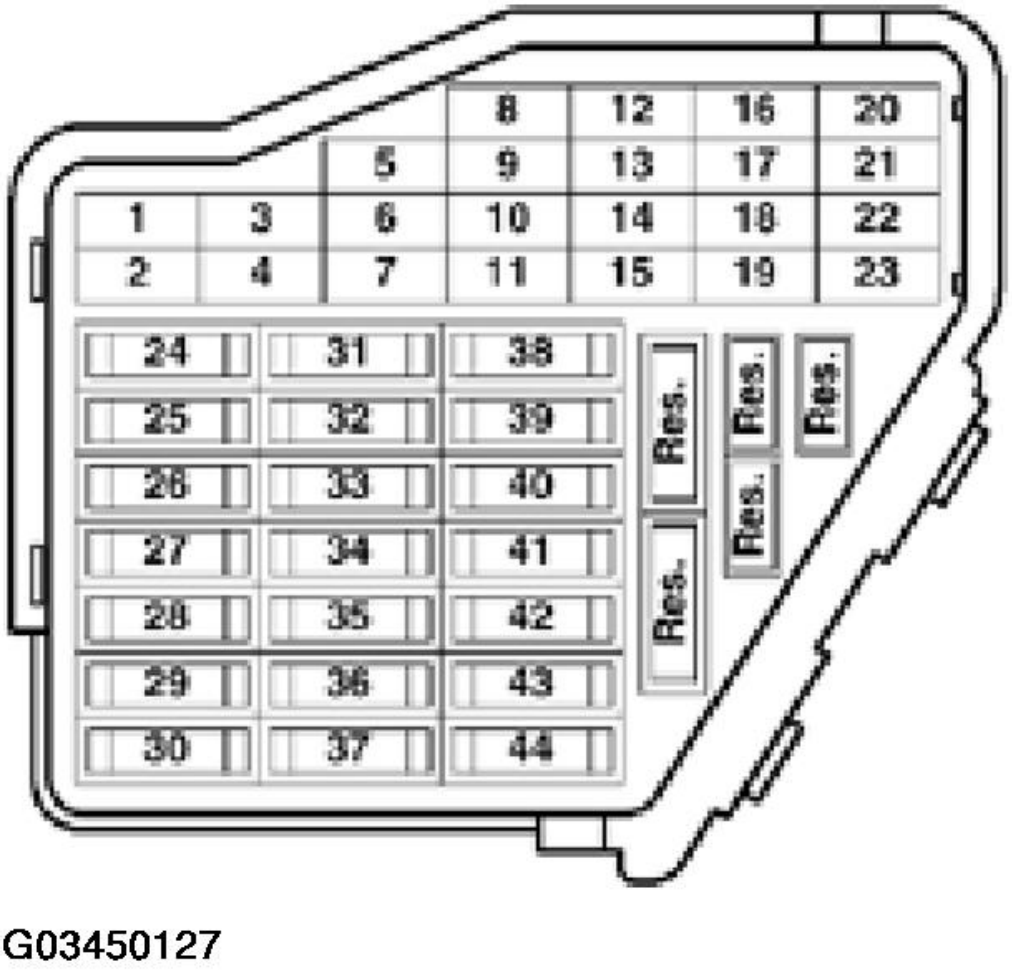


Fig. 152: Locating Fuses
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Battery voltage must be at least 11.5 V
- Air conditioner functioning OK
- Air conditioner must be switched off
- All electrical accessories, e.g. lights and rear window defroster must be switched off
- No DTCs must be stored in DTC memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING**
- Vehicle at room temperature (warmer than + 15 °C)

Test sequence

- Connect VAG 1551 scan tool ((VAG 1552). Start engine and select "Address word" 01 of Motronic Engine Control Module (ECM) -J220-. Engine must be running at idle speed. Connecting scan tool and selecting Motronic Engine Control Module (ECM) -J220-, see **VAG 1551, CONNECTING AND SELECTING MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-** .

  Indicated on display

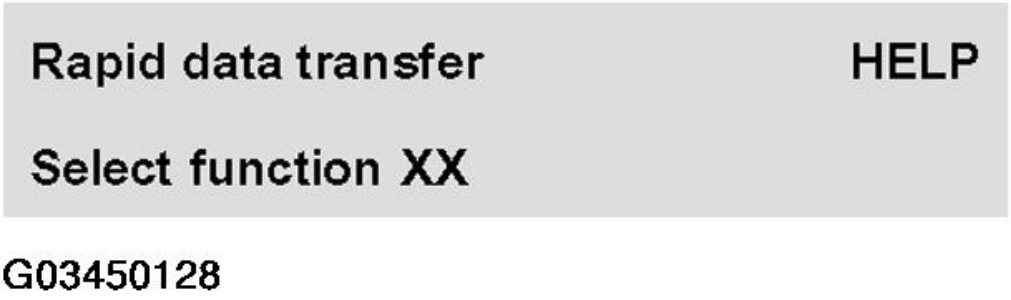


Fig. 153: Identifying Scan Tool Display - Signal From/To Air Conditioning, Checking (1 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0- and -8- for function "Read measuring value block" and confirm entry with -Q- button.

  Indicated on display

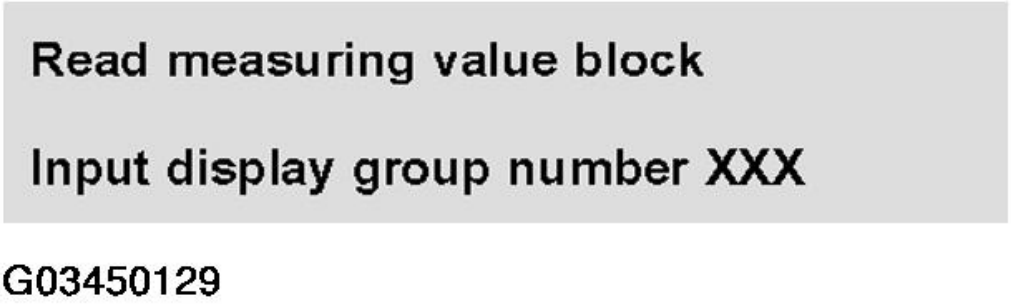


Fig. 154: Identifying Scan Tool Display - Signal From/To Air Conditioning, Checking (2 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0-, -5- and -0- for "Display group number 50" and confirm entry with -Q- button.

  Indicated on display (1 to 4 - Display zones)

G03450130

Fig. 155: Identifying Scan Tool Display - Signal From/To Air Conditioning, Checking (3 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check specifications for air conditioner (display zones 3 and 4)

DISPLAY GROUP 50: SIGNALS TO MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-

	Display zones			
	1	**2**	**3**	**4**
Display group 50: Signals to Motronic Engine Control Module (ECM) -J220-				
Display	xxxx RPM	xxxx RPM	A/C-LOW A/C-HIGH	Compr. ON Compr. OFF
Indicated	Actual engine speed (in steps of 10)	Specified engine speed (in steps of 10)	Air conditioner status	Air conditioner compressor status
Working range	0 to 6800 RPM	-	-	-
Specification	760 to 810 RPM (1) 700 to 750 RPM (2)	760 RPM (1) 700 RPM (2)	**A/C -LOW**	**Compressor on: Compr. ON** **Compressor off: Compr. OFF**
-		-	If specification is not obtained, see **SIGNAL FROM CLUTCH VACUUM VENT VALVE SWITCH -F36-, CHECKING, VEHICLES FROM MY 2001** ,	

		Continuation

(1) Engine idling at normal operating temperature for manual transmission

(2) Engine idling at normal operating temperature for automatic transmission

- Observe display in display zone 4. It must show: Compr. OFF.
- Switch on air conditioning system.
- Select lowest temperature and highest blower speed.

  Display in display zone 4 must change to Compr. ON.

- Floor accelerator pedal quickly and then release (brief burst of throttle).

  Display in display zone 4 must change from Compr.ON to Compr. OFF for a few seconds (compressor switch-off when vehicle is accelerating).

- Press --> button.
- Press buttons -0- and -6- for "End output" function and confirm input with -Q- button.
- Switch off ignition.

Continuation

If the display does not change:

- Remove inner plenum chamber cover at left:

  See **PLENUM CHAMBER INNER COVER, REMOVING AND INSTALLING**

- Connect VAG 1598/31 test box to control module wiring harness. Motronic Engine Control Module (ECM) -J220- is not connected by this action.

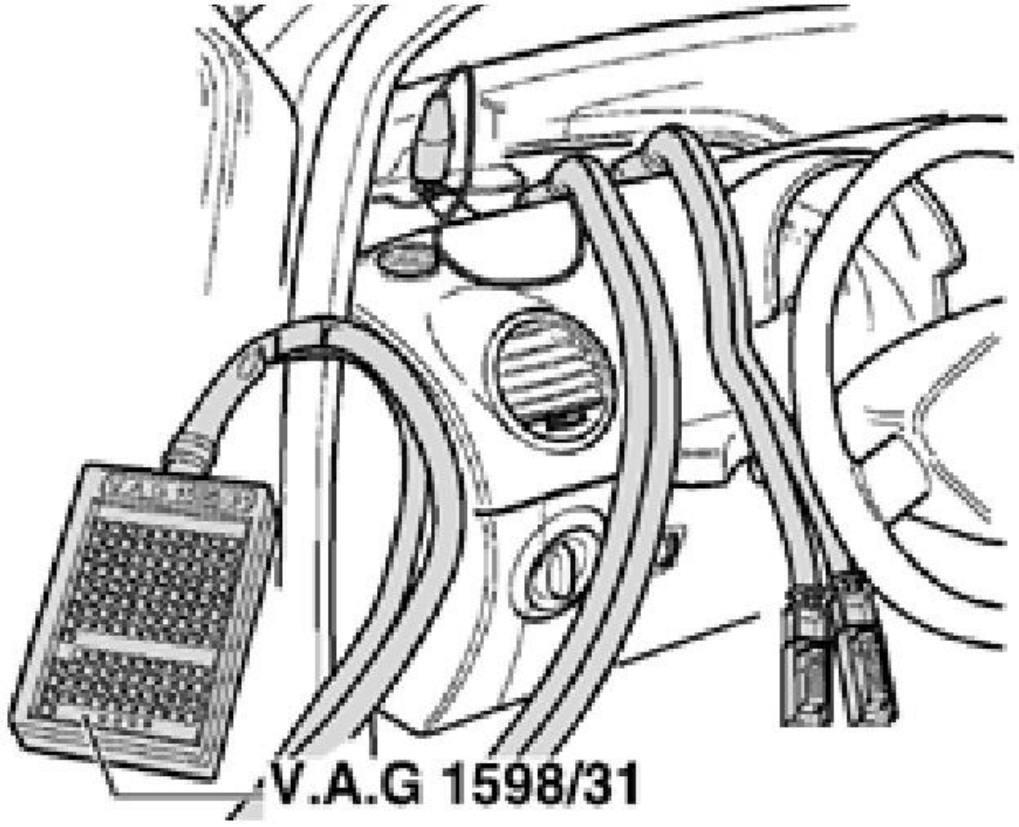


Fig. 156: Connecting VAG 1598/31 Test Box To Control Module Wiring Harness
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check wiring for open circuit between test box sockets 40 + 41 and air conditioner system using Electrical Wiring Diagram.

  Wire resistance: max. 1.5 ohm

  If no wiring malfunctions can be found:

- Check function of air conditioner control module.
- Check DTC Memory, if necessary, repair any malfunctions and then Erase DTC Memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING** .
- Read readiness code, see **READINESS CODE, DISPLAYING** . If DTC memory has been erased or

Motronic Engine Control Module (ECM) -J220- was disconnected from battery positive, readiness code must be generated again, see **READINESS CODE, GENERATING** .

Signal from Clutch Vacuum Vent Valve Switch -F36-, checking, vehicles from MY 2001

Special tools, test equipment and auxiliary items

- VAG 1551 scan tool or VAG 1552 mobile scan tool with VAG 1551/3B cable
- VAG 1598/31 test box
- VAG 1526 A or Fluke 83 multimeter
- VAG 1594 adapter set
- Electrical Wiring Diagram

Test conditions

- All fuses must be OK. Fuse holder is located behind access panel at far left end of dash.

Fig. 157: Locating Fuses
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Battery voltage must be at least 11.5 V
- All electrical accessories, e.g. lights and rear window defroster must be switched off

Test sequence

- Connect VAG 1551 scan tool (or VAG 1552). Switch ignition on and select Motronic Engine Control Module (ECM) -J220- with "Address word" 01. Connecting scan tool and selecting Motronic Engine Control Module (ECM) -J220-, see **VAG 1551, CONNECTING AND SELECTING MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-** .

Indicated on display

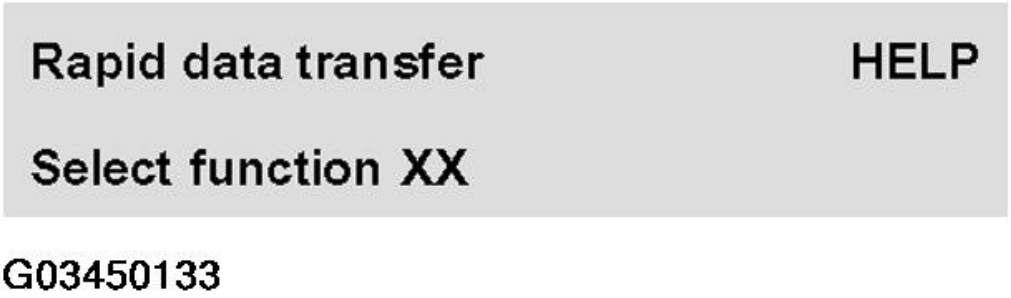


Fig. 158: Identifying Scan Tool Display - Checking Clutch Vacuum Vent Valve Switch Signal, Vehicles From MY 2001 (1 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0- and -8- for function "Read measuring value block" and confirm entry with -Q- button.

  Indicated on display

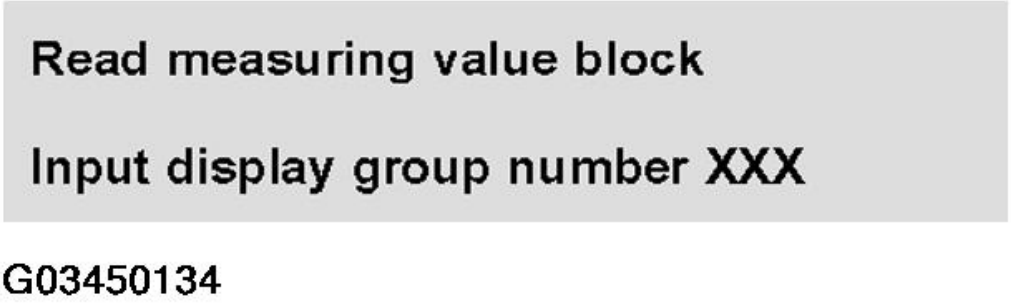


Fig. 159: Identifying Scan Tool Display - Checking Clutch Vacuum Vent Valve Switch Signal, Vehicles From MY 2001 (2 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0-, -6- and -6- for "display group 66" and confirm with -Q- button.

Indicated on display (1 to 4 - Display zones)

Fig. 160: Identifying Scan Tool Display - Checking Clutch Vacuum Vent Valve Switch Signal, Vehicles From MY 2001 (3 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Observe display in display zone 2 (3rd digit from right).

  Specification: x x x x x 0 x x

- Depress clutch pedal fully and observe display in display zone 2.

  Specification: x x x x x 1 x x

- Press --> button.
- Press buttons -0- and -6- for "End output" function and confirm input with -Q- button.
- Switch off ignition.

If the display does not change:

- Remove driver's side footwell cover:

  See **STORAGE, COVERS AND TRIMS**

- Disconnect connector from Clutch Vacuum Vent Valve Switch -F36-.
- Measure resistance between switch terminals.

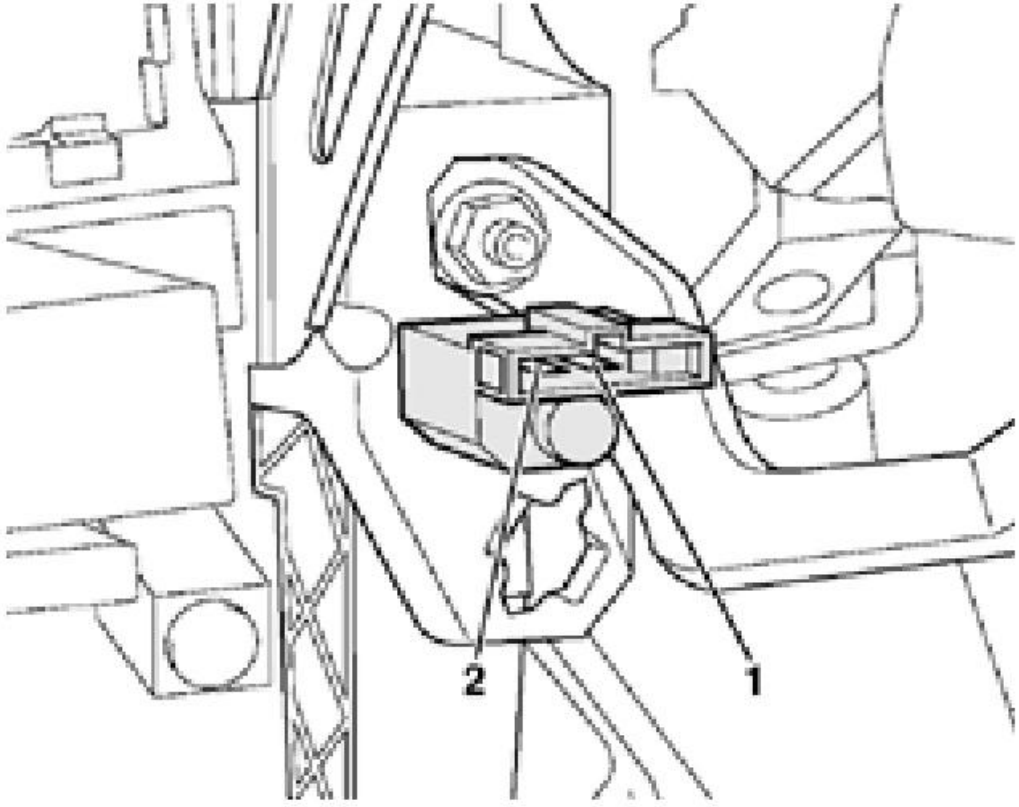


Fig. 161: Measuring Resistance Between Clutch Vacuum Vent Valve Switch Terminals
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Specification:

- Clutch not depressed: max. 1.5
- Clutch depressed: INFINITY ohm(no continuity)

If the specifications are not obtained:

- Replace Clutch Vacuum Vent Valve Switch -F36-.

NOTE: Observe installation position of Clutch Vacuum Vent Valve Switch - F36- in bearing bracket upper assembly hole.

- Check DTC Memory, if necessary, repair any malfunctions and then Erase DTC Memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING** .
- Read readiness code, see **READINESS CODE, DISPLAYING** . If DTC memory has been erased or Motronic Engine Control Module (ECM) -J220- was disconnected from battery positive, readiness code must be generated again, see **READINESS CODE, GENERATING** .

  If the specifications are obtained:

- Connect multimeter using auxiliary cables from VAG 1594 to measure voltage between terminal 2 and Ground (GND).

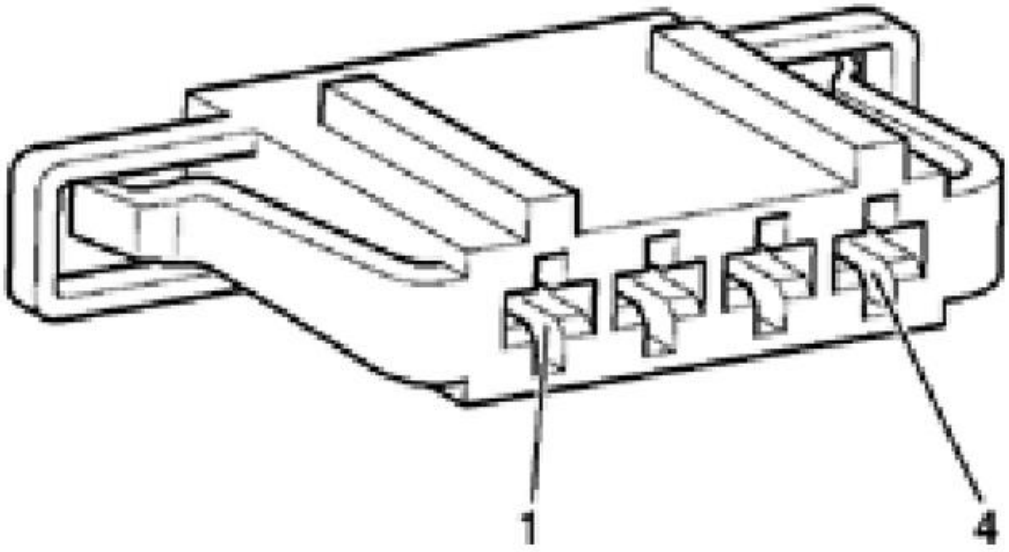


Fig. 162: Identifying Clutch Vacuum Vent Valve Switch Harness Connector Terminals
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Switch on ignition.

  Specification: min. 11.5 V

  If the specification is not obtained:

- Check wiring for open circuit between connector terminal 2 and central electric using Electrical Wiring

Diagram.

If the specification is obtained:

- Remove inner plenum chamber cover, left:

  See **PLENUM CHAMBER INNER COVER, REMOVING AND INSTALLING**

- Connect VAG 1598/31 test box to control module wiring harness. Motronic Engine Control Module (ECM) -J220- is not connected by this action.

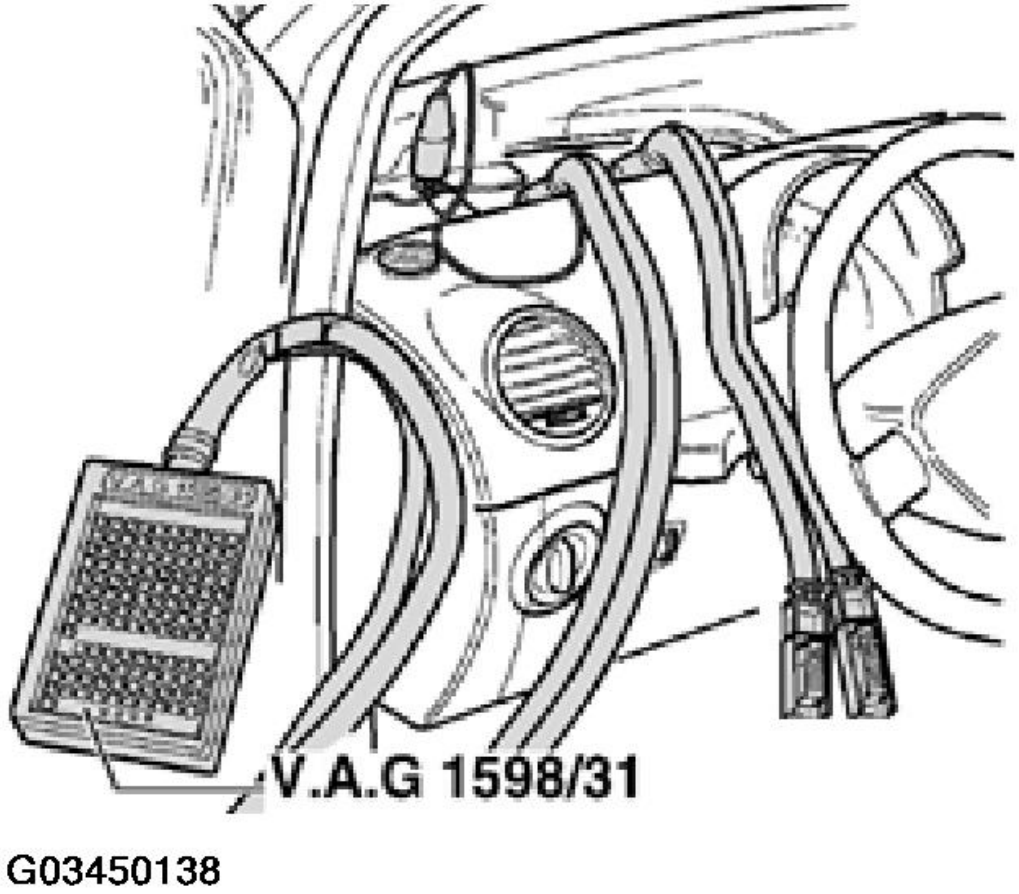


Fig. 163: Connecting Vag 1598/31 Test Box To Control Module Wiring Harness
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check wiring for open circuit between test box and connector using Electrical Wiring Diagram.

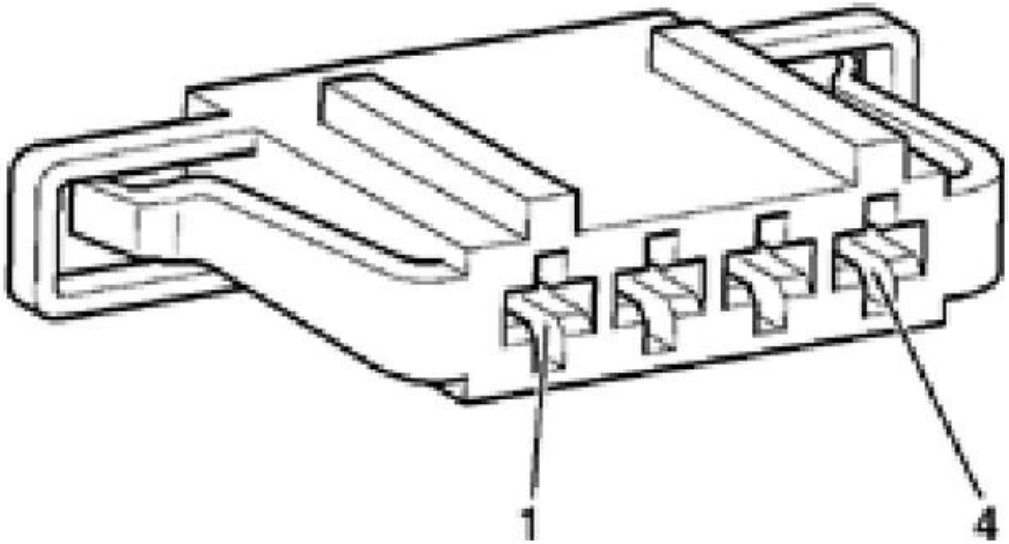


Fig. 164: Identifying Clutch Vacuum Vent Valve Switch Harness Connector Terminals
Courtesy of VOLKSWAGEN OF AMERICA, INC.

terminal 3 + socket 39

Wire resistance: Max. 1.5 ohm

If the specification is obtained:

- Additionally check wires for short to one another.
- Additionally check wiring for short to battery positive or Ground GND).

If no wiring malfunction is found:

- Replace Motronic Engine Control Module (ECM) -J220-, see **MOTRONIC ENGINE CONTROL MODULE (ECM) - J220-, REPLACING** .

Signal from Clutch Vacuum Vent Valve Switch -F36-, checking, vehicles through MY 2000

Special tools, test equipment and auxiliary items

- VAG 1551 scan tool or VAG 1552 mobile scan tool with VAG 1551/3B cable

- VAG 1598/31 test box
- VAG 1526 A or Fluke 83 multimeter
- VAG 1594 adapter set
- Electrical Wiring Diagram

Test conditions

- All fuses must be OK. Fuse holder is located behind access panel at far left end of dash.

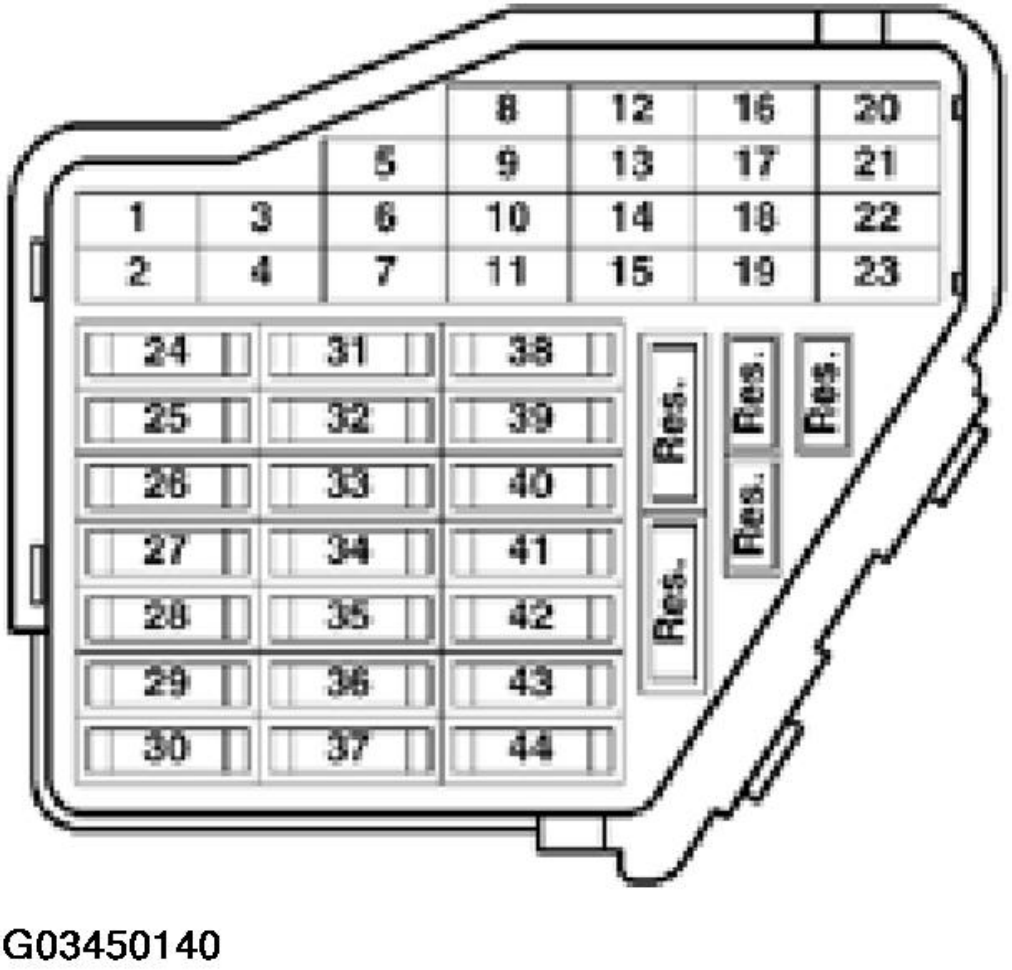


Fig. 165: Locating Fuses
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Battery voltage must be at least 11.5 V
- All electrical accessories, e.g. lights and rear window defroster must be switched off

Test sequence

- Connect VAG 1551 scan tool ((VAG 1552). Switch ignition on and select Motronic Engine Control Module (ECM) -J220- with "Address word" 01. Connecting scan tool and selecting Motronic Engine Control Module (ECM) -J220-, see **VAG 1551, CONNECTING AND SELECTING MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-** .

  Indicated on display

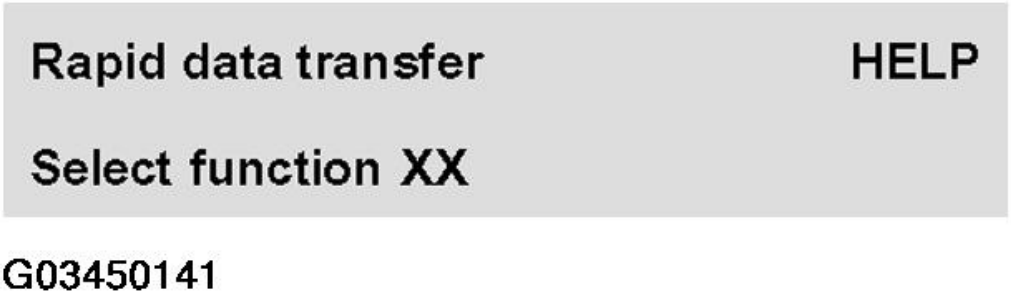


Fig. 166: Identifying Scan Tool Display - Checking Signal From Clutch Vacuum Vent Valve Switch, Vehicles Through MY 2000 (1 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0- and -8- for function "Read measuring value block" and confirm entry with -Q- button.

  Indicated on display

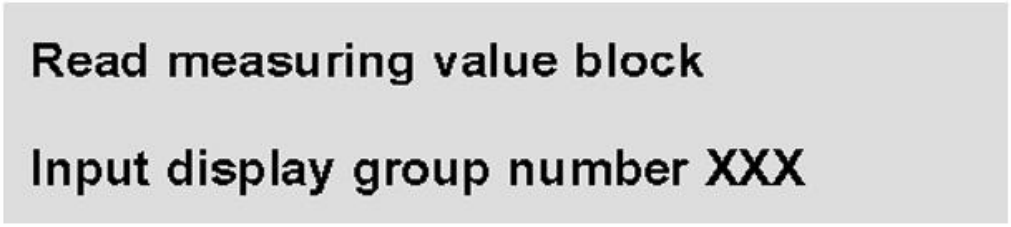


Fig. 167: Identifying Scan Tool Display - Checking Signal From Clutch Vacuum Vent Valve Switch, Vehicles Through MY 2000 (2 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0-, -6- and -6- for "display group 66" and confirm with -Q- button.

  Indicated on display (1 to 4 - Display zones)

Fig. 168: Identifying Scan Tool Display - Checking Signal From Clutch Vacuum Vent Valve Switch, Vehicles Through MY 2000 (3 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Observe values displayed in display zone 2 (2nd digit from left).

  Clutch pedal not depressed.

Specification: x 0 x x

- Depress clutch pedal fully and observe display in display zone 2.

Specification: x 1 x x

- Press --> button.
- Press buttons -0- and -6- for "End output" function and confirm input with -Q- button.
- Switch off ignition.

If the display does not change:

- Remove driver's side footwell cover.

See **STORAGE, COVERS AND TRIMS**

- Disconnect 2-pin connector from Clutch Vacuum Vent Valve Switch -F36-.
- Measure resistance between switch terminals 1 and 2.

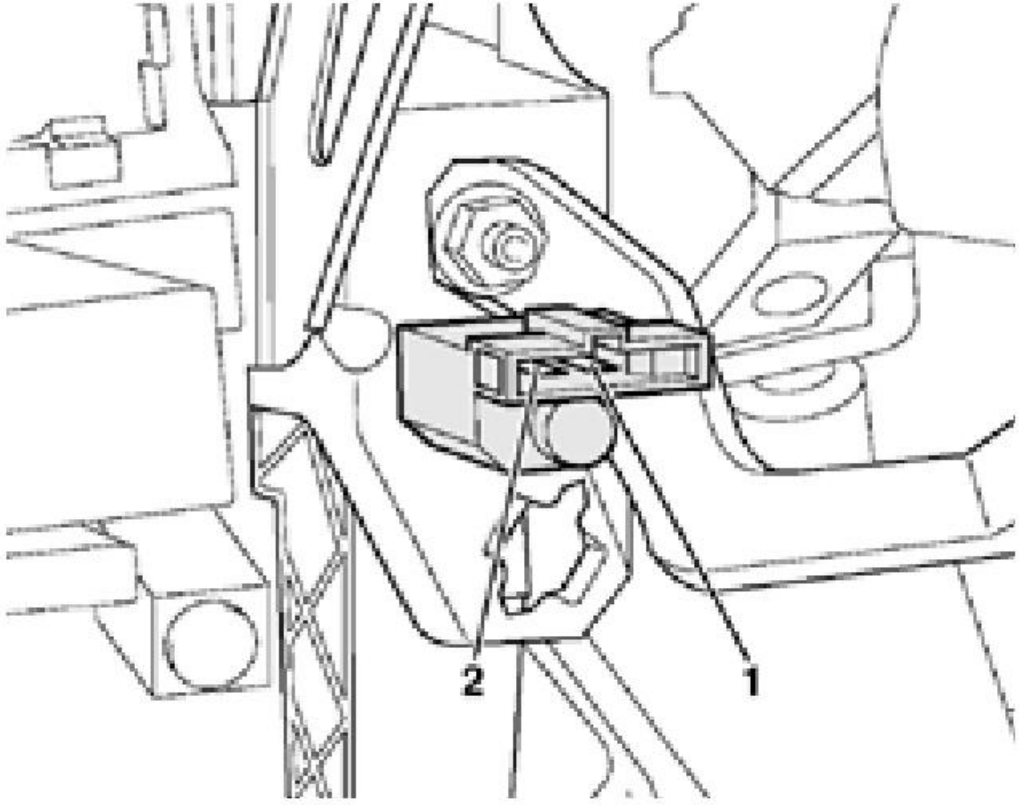


Fig. 169: Measuring Resistance Between Clutch Vacuum Vent Valve Switch Terminals
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Specification:

- Clutch not depressed: max. 1.5
- Clutch depressed: (no continuity)

If the specifications are not obtained:

- Replace Clutch Vacuum Vent Valve Switch -F36-.

NOTE: Observe installation position of Clutch Vacuum Vent Valve Switch - F36- in bearing bracket upper assembly hole.

- Check DTC Memory, if necessary, repair any malfunctions and then Erase DTC Memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING** .
- Read readiness code, see **READINESS CODE, DISPLAYING** . If DTC memory has been erased or Motronic Engine Control Module (ECM) -J220- was disconnected from battery positive, readiness code must be generated again, see **READINESS CODE, GENERATING** .

  If the specifications are obtained:

- Connect multimeter using auxiliary cables from VAG 1594 to measure voltage between terminal 1 and Ground (GND).

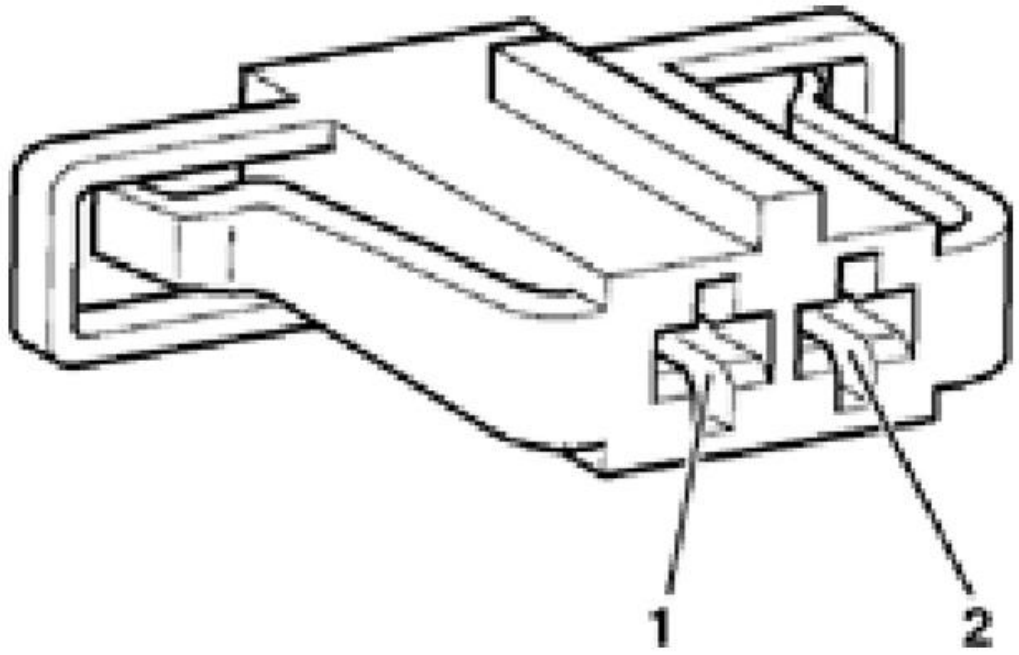


Fig. 170: Identifying Clutch Vacuum Vent Valve Switch Harness Connector Terminals
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Switch on ignition.

  Specification: min. 11.5 V

If the specification is not obtained:

- Check wiring for open circuit between 2 -pin connector terminal 1 and central electric using Electrical Wiring Diagram.

If the specification is obtained:

- Remove inner plenum chamber cover, left:

See **PLENUM CHAMBER INNER COVER, REMOVING AND INSTALLING**

- Connect VAG 1598/31 test box to control module wiring harness. Motronic Engine Control Module (ECM) -J220- is not connected by this action.

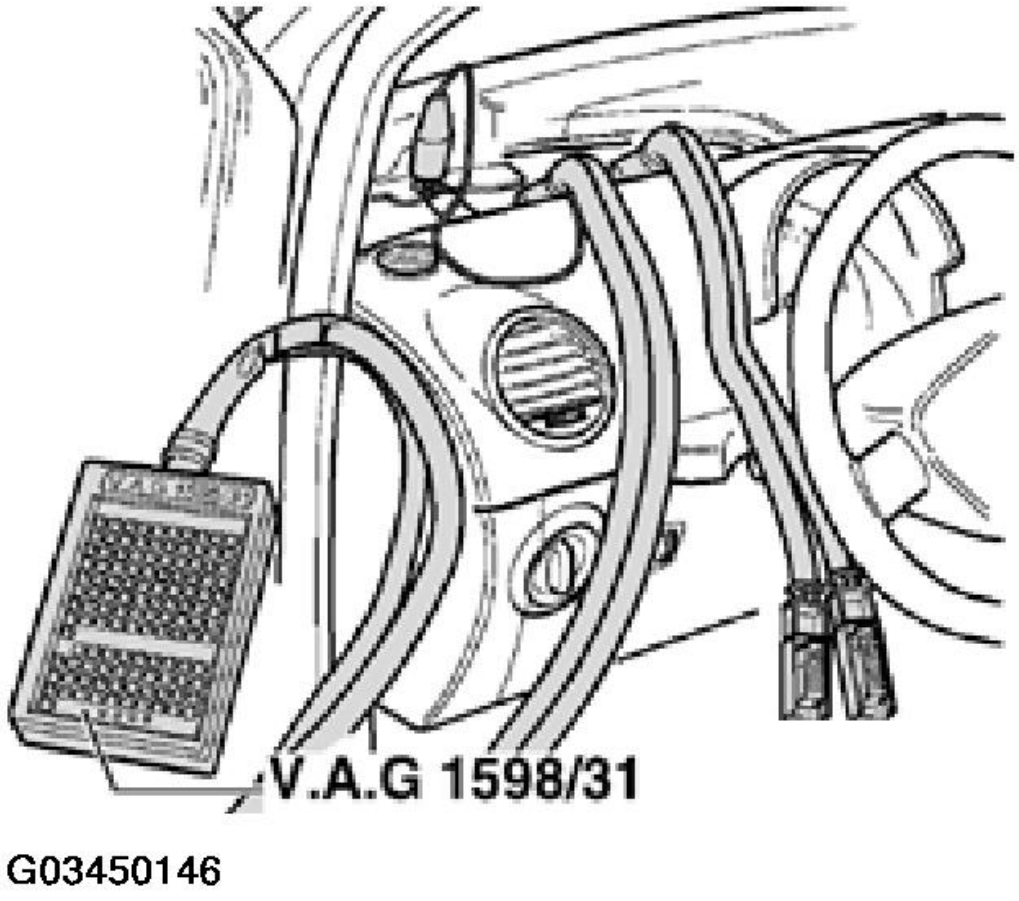


Fig. 171: Connecting VAG 1598/31 Test Box To Control Module Wiring Harness

Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check wiring for open circuit between test box and 2 -pin connector using Electrical Wiring Diagram.

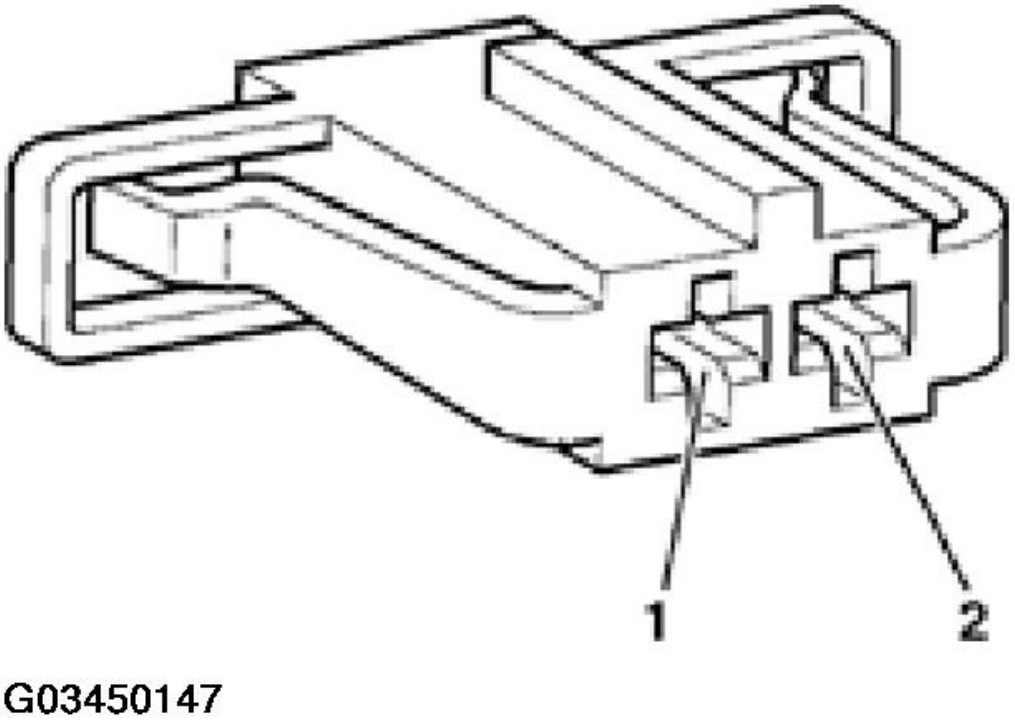


Fig. 172: Identifying Clutch Vacuum Vent Valve Switch Harness Connector Terminals
Courtesy of VOLKSWAGEN OF AMERICA, INC.

terminal 2 + socket 39

Wire resistance: Max. 1.5

If the specification is obtained:

- Additionally check wires for short to one another.
- Additionally check wiring for short to battery positive or Ground (GND).

If no wiring malfunction is found:

- Replace Motronic Engine Control Module (ECM) -J220-, see **MOTRONIC ENGINE CONTROL MODULE (ECM) - J220-, REPLACING** .

Signal from Brake Light Switch -F- and Brake Vacuum Vent Valve Switch -F47-, checking

Special tools, test equipment and auxiliary items

- VAG 1551 scan tool or VAG 1552 mobile scan tool with VAG 1551/3B cable
- VAG 1598/31 test box
- VAG 1526 A or Fluke 83 multimeter
- VAG 1594 adapter set
- Electrical Wiring Diagram

Test conditions

- All fuses must be OK

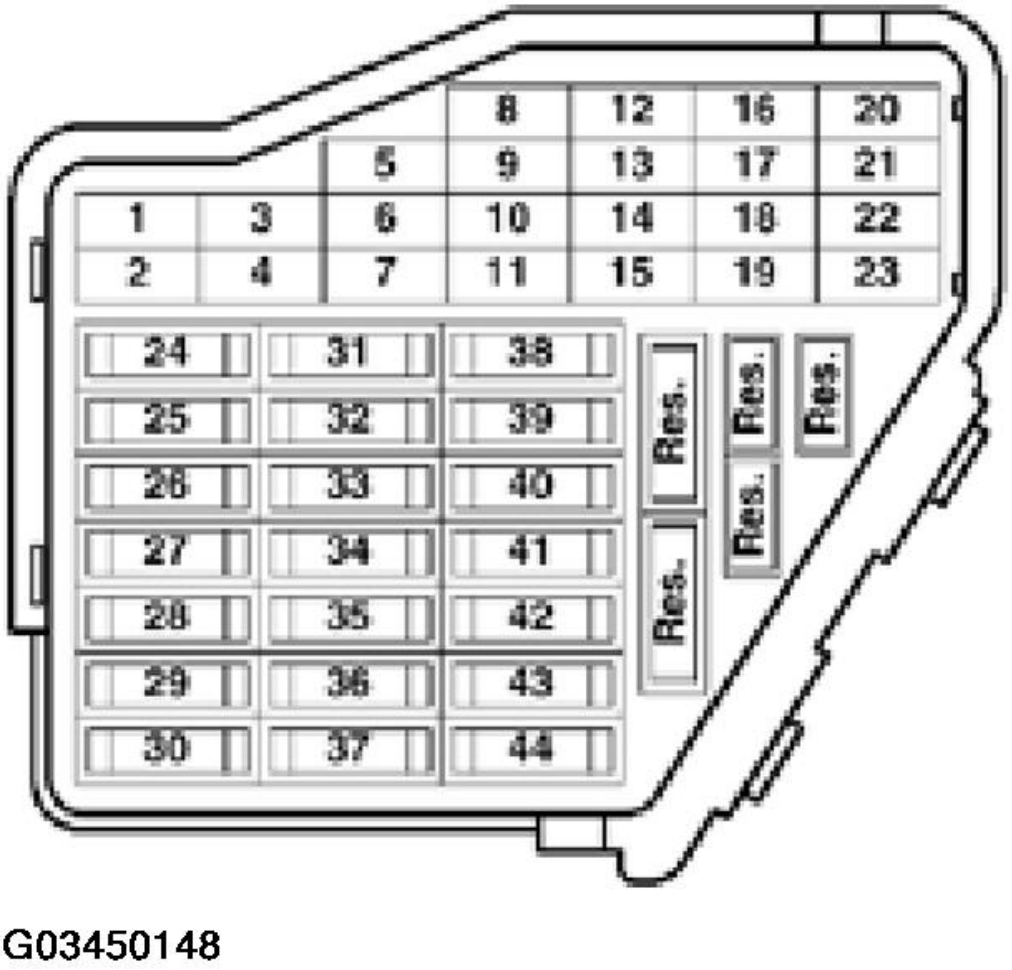


Fig. 173: Locating Fuses
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Battery voltage must be at least 11.5 V
- Brake lights functioning OK
- All electrical accessories, e.g. lights and rear window defroster must be switched off
- Selector lever must be in position "P" or "N" on vehicles with an automatic transmission

Test sequence

- Connect VAG 1551 scan tool ((VAG 1552). Switch ignition on and select Motronic Engine Control Module (ECM) -J220- with "Address word" 01. Connecting scan tool and selecting Motronic Engine Control Module (ECM) -J220-, see **VAG 1551, CONNECTING AND SELECTING MOTRONIC**

ENGINE CONTROL MODULE (ECM) -J220- .

Indicated on display

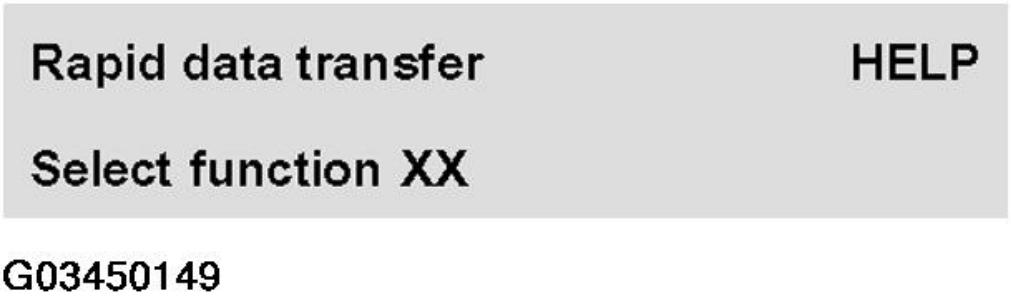


Fig. 174: Identifying Scan Tool Display - Checking Signal From Brake Light Switch And Brake Vacuum Vent Valve Switch (1 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0- and -8- for function "Read measuring value block" and confirm entry with -Q- button.

  Indicated on display

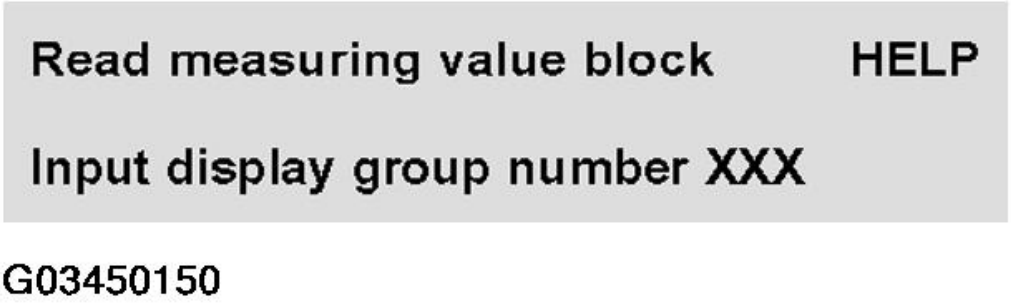


Fig. 175: Identifying Scan Tool Display - Checking Signal From Brake Light Switch And Brake Vacuum Vent Valve Switch (2 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0-, -6- and -6- for "display group 66" and confirm with -Q- button.

  Indicated on display (1 to 4 - Display zones)

G03450151

Fig. 176: Identifying Scan Tool Display - Checking Signal From Brake Light Switch And Brake Vacuum Vent Valve Switch (3 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Observe display in display zone 2: (1st and 2nd positions from right)

  Brake pedal not depressed:

  Specification: x x x x x x 0 0

- Depress brake pedal fully and observe display in display zone 2.

  Specification: x x x x x x 1 1

- Press --> button.
- Press buttons -0- and -6- for "End output" function and confirm input with -Q- button.
- Switch off ignition.

  If the display does not change:

- Remove driver's side footwell cover:

  See **STORAGE, COVERS AND TRIMS**

- Disconnect 4-pin connector from Brake Light Switch -F- and Brake Vacuum Vent Valve Switch -F47-.
- Measure resistance between terminals 1 + 4 of switch.

Specification:

- Brake pedal not depressed: (no continuity)
- Brake pedal depressed: Max. 1.5

- Measure resistance between terminals 2 + 3 of the switch.

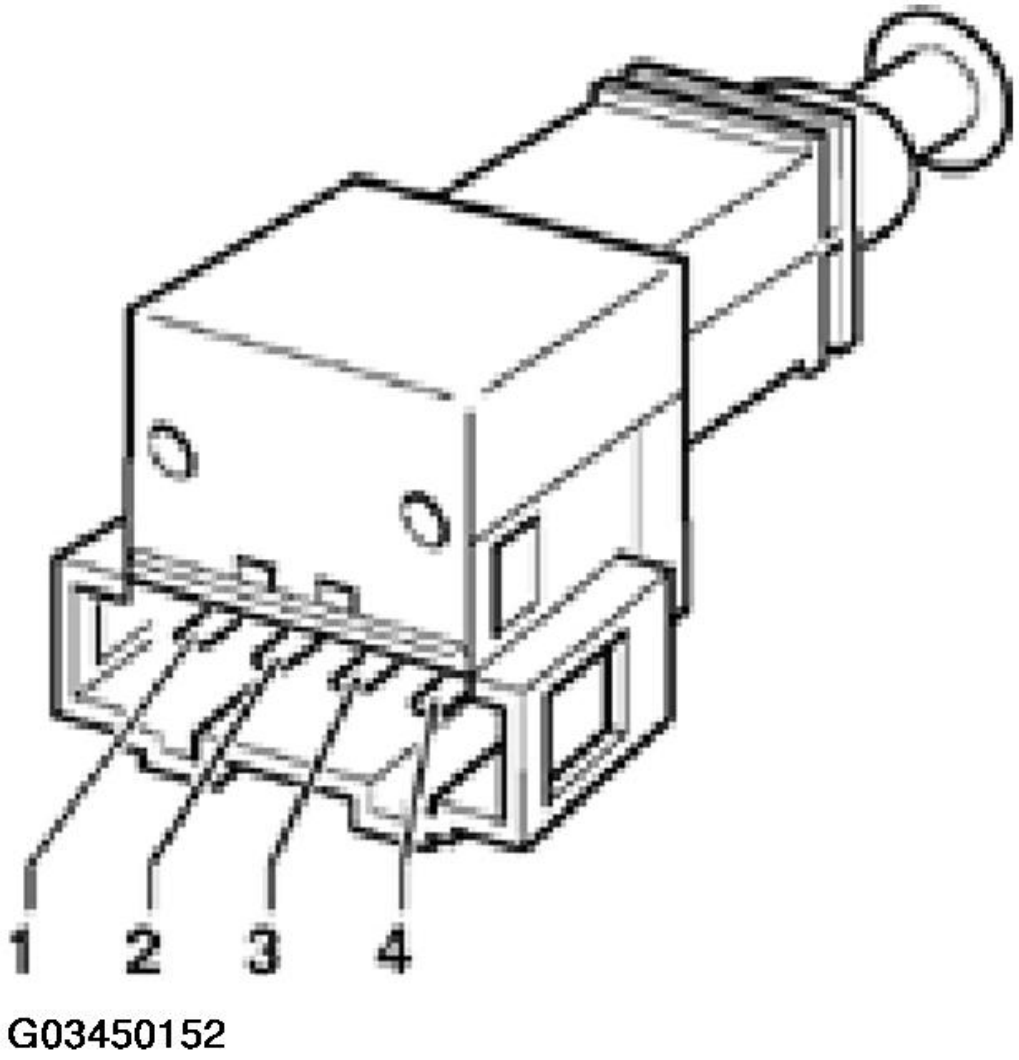


Fig. 177: Identifying Brake Light Switch And Brake Vacuum Vent Valve Switch Terminals
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Specification: 0 ohm

- Brake pedal not depressed: Max. 1.5
- Brake pedal depressed: (no continuity)

If the specifications are not obtained:

- Replace Brake Light Switch -F- and Brake Vacuum Vent Valve Switch -F47-.
- Check DTC Memory, if necessary, repair any malfunctions and then Erase DTC Memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING** .
- Read readiness code, see **READINESS CODE, DISPLAYING** . If DTC memory has been erased or Motronic Engine Control Module (ECM) -J220- was disconnected from battery positive, readiness code must be generated again, see **READINESS CODE, GENERATING** .

If the specifications are obtained:

- Connect multimeter to measure voltage between terminal 1 and Ground (GND).

Specification: at least 11.5 V

- Connect multimeter to measure voltage between terminal 2 and Ground (GND).
- Switch on ignition.

Specification: min. 11.5 V

If the specifications are not obtained:

- Check wiring between 4 -pin connector terminals 1 and 2 to central electric using Electrical Wiring Diagram.

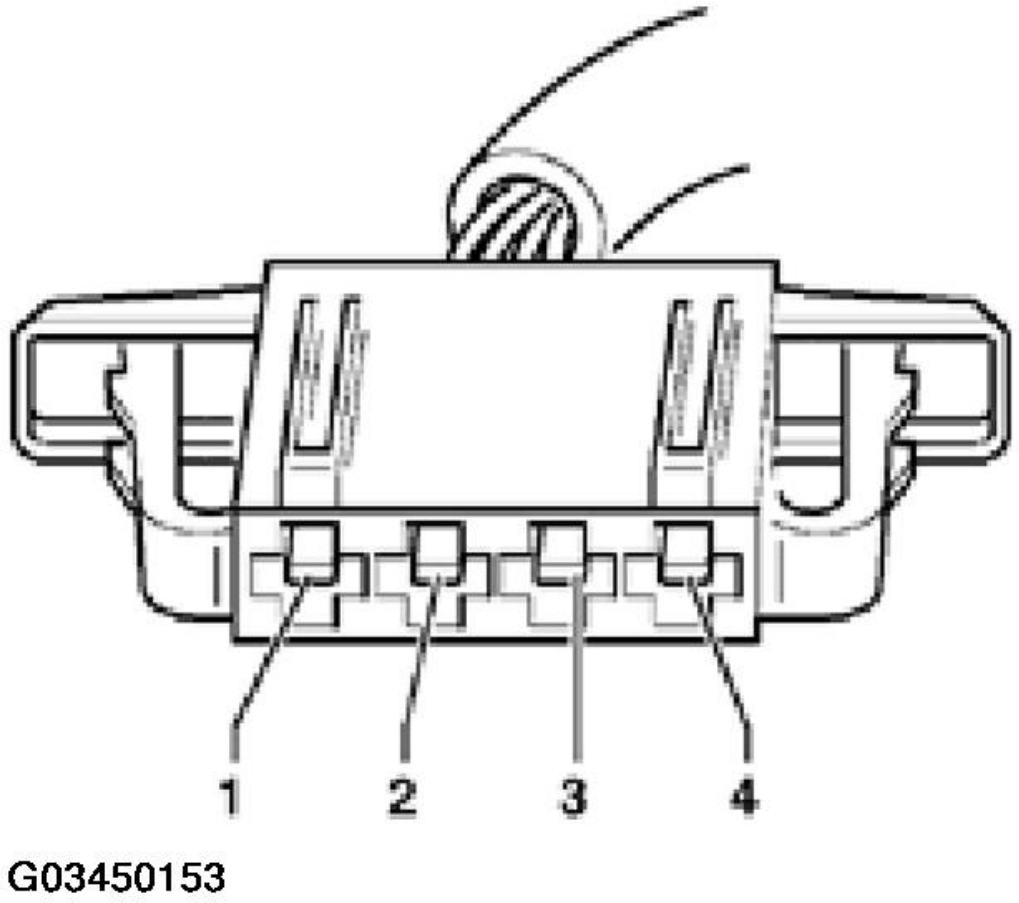


Fig. 178: Identifying Brake Light Switch And Brake Vacuum Vent Valve Switch Harness Connector Terminals
Courtesy of VOLKSWAGEN OF AMERICA, INC.

If the specifications are obtained:

- Remove inner plenum chamber cover, left:

  See **PLENUM CHAMBER INNER COVER, REMOVING AND INSTALLING**

- Connect VAG 1598/31 test box to control module wiring harness. Motronic Engine Control Module (ECM) -J220- is not connected by this action.

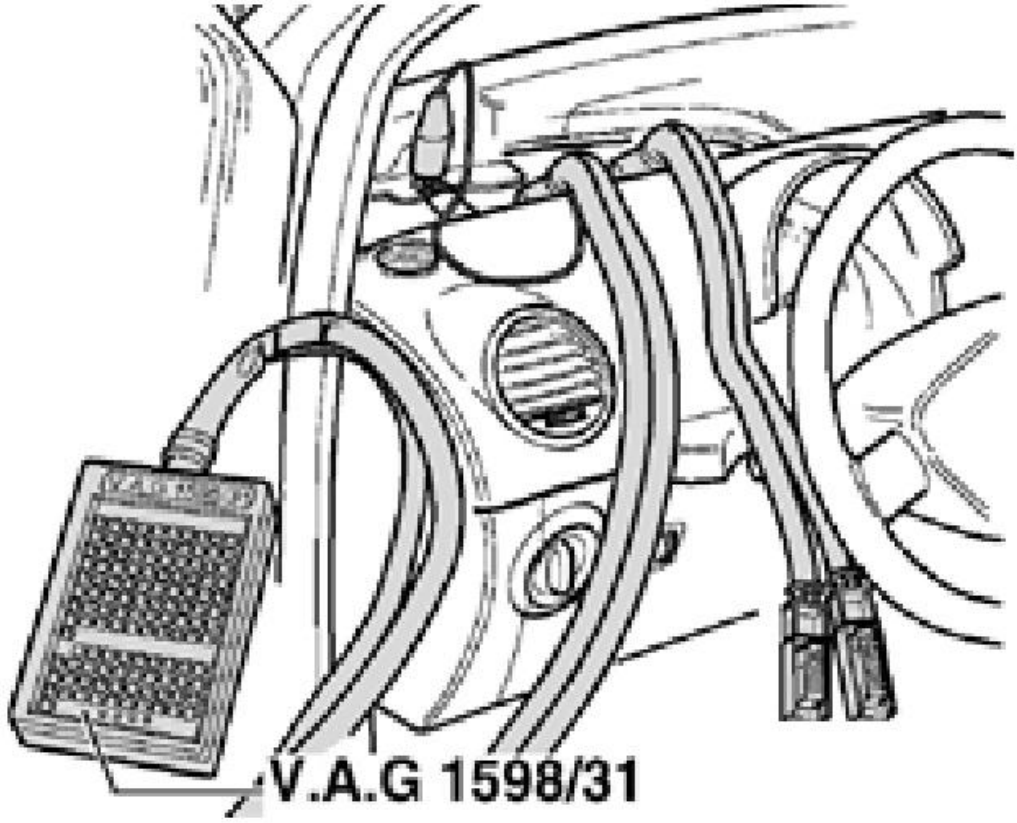


Fig. 179: Connecting VAG 1598/31 Test Box To Control Module Wiring Harness
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check wiring for open circuit between test box and 4 -pin connector using Electrical Wiring Diagram.

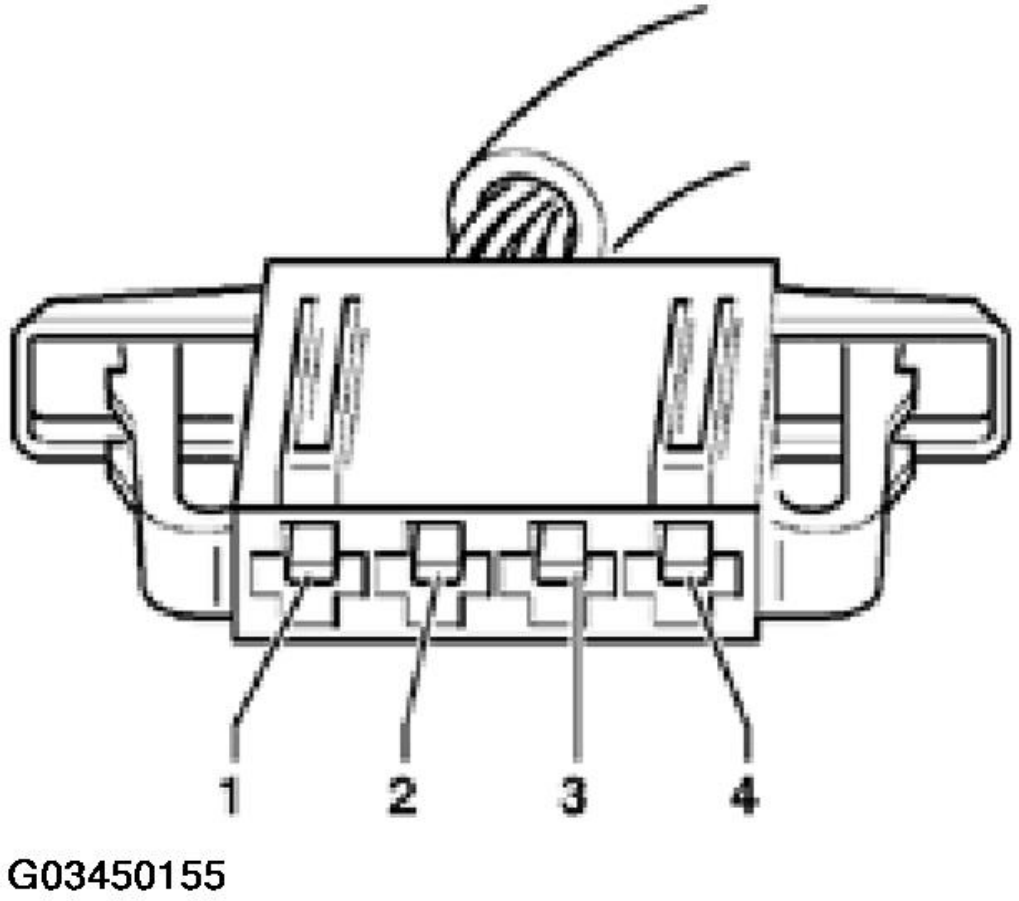


Fig. 180: Identifying Brake Light Switch And Brake Vacuum Vent Valve Switch Harness Connector Terminals
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- terminal 3 + socket 55
- terminal 4 + socket 56

Wire resistance: Max. 1.5 ohm

- Also check wires for short to one another.
- Also check wiring for short to battery positive or Ground (GND).

If no wiring malfunction is found:

- Replace Motronic Engine Control Module (ECM) -J220-, see **MOTRONIC ENGINE CONTROL**

MODULE (ECM) - J220-, REPLACING .

Driving range signal, checking

Vehicles with automatic transmission only

Motronic Engine Control Module (ECM) -J220- receives the following information from transmission control module:

- Driving range selected (selector lever in 1/2/3/R/D) or
- No driving range selected (selector lever in P or N)

Special tools, test equipment and auxiliary items

- VAG 1551 scan tool (or VAG 1552 mobile scan tool) with VAG 1551/3B cable
- VAG 1598/31 test box
- VAG 1526 A or Fluke 83 multimeter
- VAG 1594 adapter set
- Electrical Wiring Diagram

Test conditions

- Selector lever of the automatic transmission must be in "P" or "N" position
- Air conditioning must be turned off
- All electrical accessories, e.g. lights and rear window defroster must be switched off

Test sequence

- Connect VAG 1551 scan tool (or VAG 1552). Switch ignition on and select Motronic Engine Control Module (ECM) -J220- with "Address word" 01. Connecting scan tool and selecting Motronic Engine Control Module (ECM) -J220-, see **VAG 1551, CONNECTING AND SELECTING MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-** .

  Indicated on display

Fig. 181: Identifying Scan Tool Display - Driving Range Signal, Checking (1 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0- and -8- for function "Read measuring value block" and confirm entry with -Q- button.

  Indicated on display

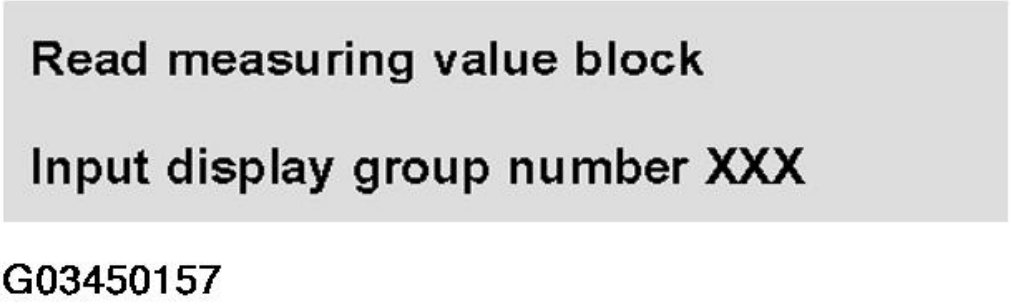


Fig. 182: Identifying Scan Tool Display - Driving Range Signal, Checking (2 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0-, -5- and -1- for "Display group number 51" and confirm entry with -Q- button.

  Indicated on display (1 to 4 - Display zones)

Fig. 183: Identifying Scan Tool Display - Driving Range Signal, Checking (3 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check specifications in display zone 3:

DISPLAY GROUP 51: DRIVING RANGE SIGNAL

	Display zones			
	1	**2**	**3**	**4**
Display group 51: Driving range signal				
Display Indicated	xxxx RPM Engine Speed (in steps of 10)	xxxx RPM Engine speed (in steps of 10)	x Driving range signal	xx.xxx V Motronic Engine Control Module (ECM) -J220- supply voltage
Working range	0 to 6800 RPM	-	-	0.000 to 16.500 V
Specification	0 RPM	840 RPM	Selector lever in position P or N: 0 Selector lever in position 1/2/3 or D: 1 Selector lever in position R: 7	12.000 to 15.000 V
	-	-	If the specifications are not achieved, see **CRUISE CONTROL SYSTEM (CCS), CHECKING** , Continuation	-

If the specifications are obtained:

- Press --> button.
- Press buttons -0- and -6- for "End output" function and confirm input with -Q- button.
- Switch off ignition.

Continuation

If the specifications are not obtained:

- Press --> button.
- Press buttons -0- and -6- for "End output" function and confirm input with -Q- button.
- Switch off ignition.
- Check CAN-bus, see **CAN-BUS, CHECKING** .

Cruise Control System (CCS), checking

Special tools, test equipment and auxiliary items

- VAG 1551 scan tool or VAG 1552 mobile scan tool with VAG 1551/3B cable
- VAG 1598/31 test box
- VAG 1526 A or Fluke 83 multimeter
- VAG 1594 adapter set
- Electrical Wiring Diagram

Test conditions

- All fuses must be OK

Fig. 184: Locating Fuses
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Battery voltage must be at least 11.5 V
- All electrical accessories, e.g. lights and rear window defroster must be switched off
- Air conditioning must be turned off
- Selector lever of the automatic transmission must be in "P" or "N" position

Test sequence

- Connect VAG 1551 scan tool ((VAG 1552). Switch ignition on and select Motronic Engine Control Module (ECM) -J220- with "Address word" 01. Connecting scan tool and selecting Motronic Engine Control Module (ECM) -J220-, see **VAG 1551, CONNECTING AND SELECTING MOTRONIC**

ENGINE CONTROL MODULE (ECM) -J220- .

Indicated on display

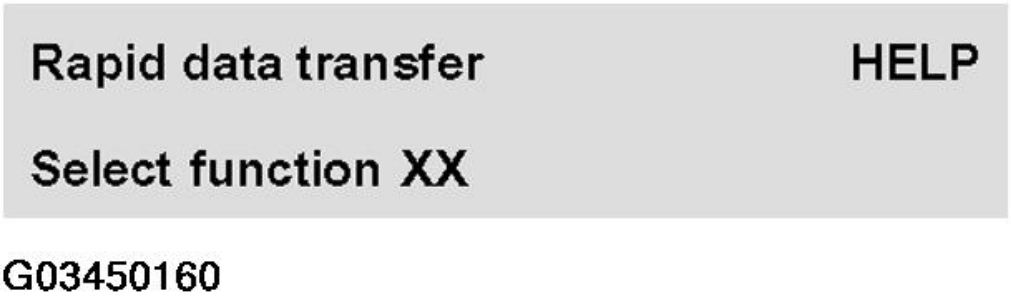


Fig. 185: Identifying Scan Tool Display - Cruise Control System, Checking (1 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0- and -8- for function "Read measuring value block" and confirm entry with -Q- button.

  Indicated on display

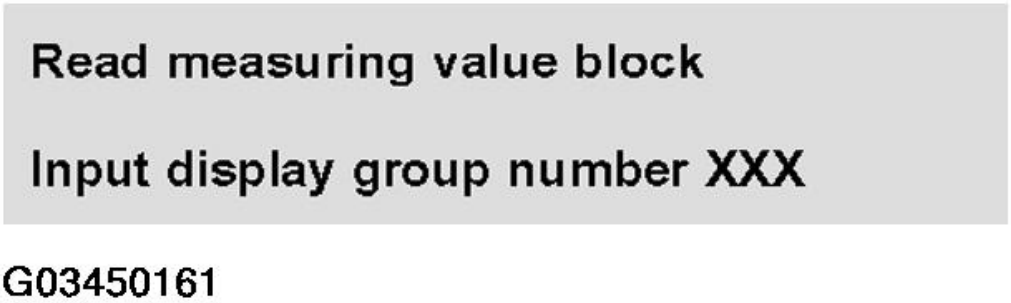


Fig. 186: Identifying Scan Tool Display - Cruise Control System, Checking (2 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Press buttons -0-, -6- and -6- for "display group 66" and confirm with -Q- button.

Indicated on display (1 to 4 - Display zones)

Fig. 187: Identifying Scan Tool Display - Cruise Control System, Checking (3 Of 3)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

NOTE: Vehicles with automatic transmission only:

- **Perform a test drive and exceed a speed of 30 km/h (approx. 19 MPH) once. Afterward switch off engine and leave selector lever in position 2, 3 or D.**

Observe the valid safety measures during a test drive, see **SAFETY PRECAUTIONS** .

- Engage parking brake.

NOTE: On vehicles with an automatic transmission, the CCS switch will not be supplied with voltage until the vehicle speed exceeds 30 km/h and the selector lever is in position 2, 3 or D. Once the switch has been supplied with voltage it will also remain live at idle speed provided a driving range (except 1 or R) is selected.

- Check in display zone 2 if the CCS is activated:

  Specification: x x x x 1x x x

  If the specification is not obtained:

- Press --> button.
- Press buttons -0- and -6- for "End output" function and confirm input with -Q- button.
- Activate Cruise Control System.

See **CRUISE CONTROL**

If the specification is obtained:

- Check specification for switch position from CCS operating switch in display zone 4 (last 4-digit numbers).

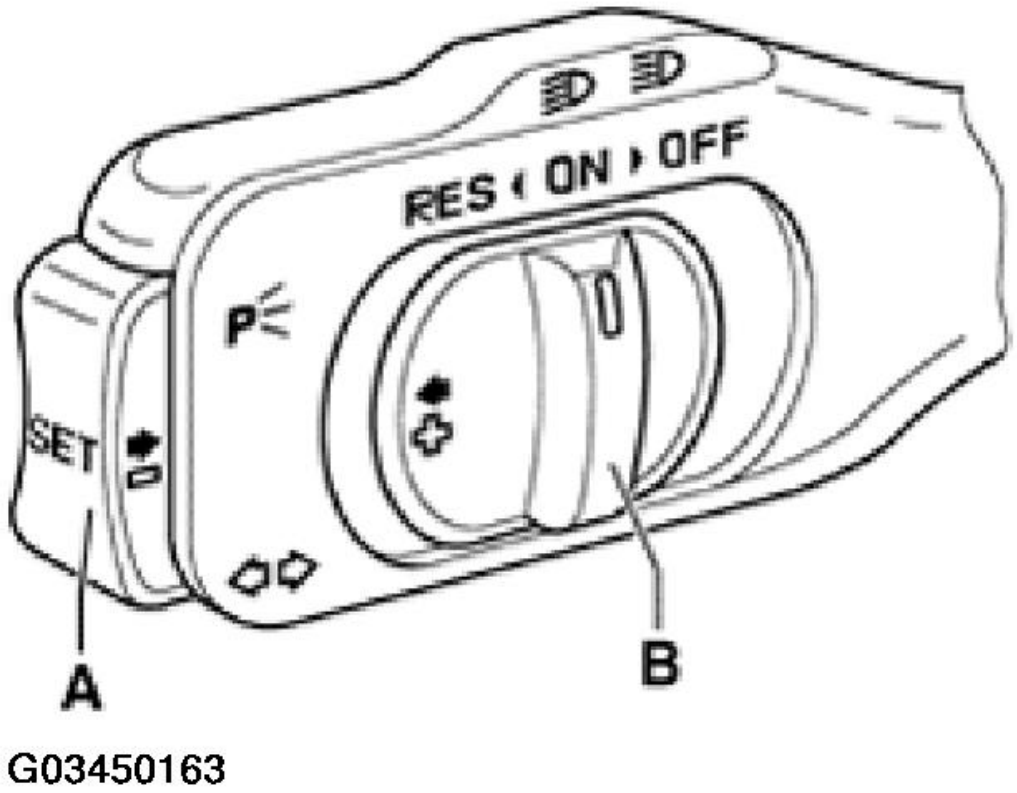


Fig. 188: Checking Switch Position From CCS Operating Switch In Display Zone 4
Courtesy of VOLKSWAGEN OF AMERICA, INC.

SWITCH IN DISPLAY ZONE 4 SPECIFICATION

Check prerequisites	Display zone 4
Switch B in detent at "OFF"	0001
Switch B not in detent at "OFF"	0000
Switch B at "ON"	0011
Switch B at "RES"	1011
Switch A pressed	0111

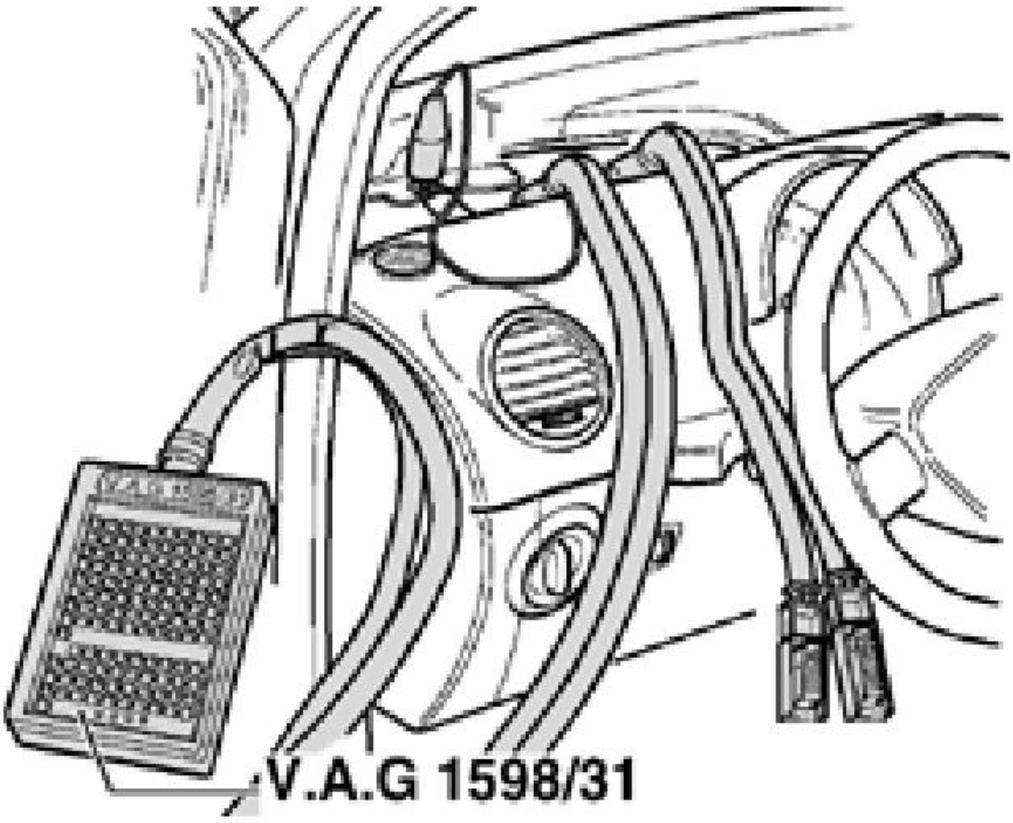
(Switch B at "ON")	

If the specifications are not obtained:

- Press --> button.
- Press buttons -0- and -6- for "End output" function and confirm input with -Q- button.
- Switch off ignition.
- Remove inner plenum chamber cover, left:

See **PLENUM CHAMBER INNER COVER, REMOVING AND INSTALLING**

- Connect VAG 1598/31 test box to control module wiring harness. Motronic Engine Control Module (ECM) -J220- is not connected by this action.



G03450164

Fig. 189: Connecting VAG 1598/31 Test Box To Control Module Wiring Harness
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Check wiring from Motronic Engine Control Module (ECM) -J220- to CCS operating switch for open/short circuits:
- Check DTC Memory, if necessary, repair any malfunctions and then Erase DTC Memory, see **DTC MEMORY OF MOTRONIC ENGINE CONTROL MODULE (ECM) -J220-, CHECKING AND ERASING** .
- Read readiness code, see **READINESS CODE, DISPLAYING** . If DTC memory has been erased or Motronic Engine Control Module (ECM) -J220- was disconnected from battery positive, readiness code must be generated again, see **READINESS CODE, GENERATING** .

CAN-bus, checking

Function

The Motronic Engine Control Module (ECM) - J220- communicates with all data -bus capable control modules via a CAN -bus.

The data-bus capable control modules are connected and exchange information (messages) via two data -bus wires (CAN -High and CAN-Low) that are twisted to each other. Missing information on the data-bus is recognized as a malfunction by the Motronic Engine Control Module (ECM) -J220- as well as by other CAN-bus control modules.

The data-bus requires an adapting resistor to function fault-free. This central adapting resistor is located in the Motronic Engine Control Module (ECM) -J220-.

Diagnosis via the CAN-bus wire is undertaken via the diagnostic interface for data -bus -J533- in the "Gateway".

See **DATA BUS ON BOARD DIAGNOSTIC INTERFACE -J533- "GATEWAY"**

NOTE: Control modules which are actively connected via data bus to the Motronic Engine Control Module (ECM) -J220- can be read in measured value blocks 125 and 126.

Further information:

See Self Study Program "The CAN data bus".

Special tools and equipment

- VAG 1598/31 test box
- Multimeter (Fluke 83 or equivalent)
- VW 1594 adapter set

- Electrical Wiring Diagram

Test conditions

- Malfunction has been recognized by Data Bus On Board Diagnostic (OBD)
- All fuses must be OK

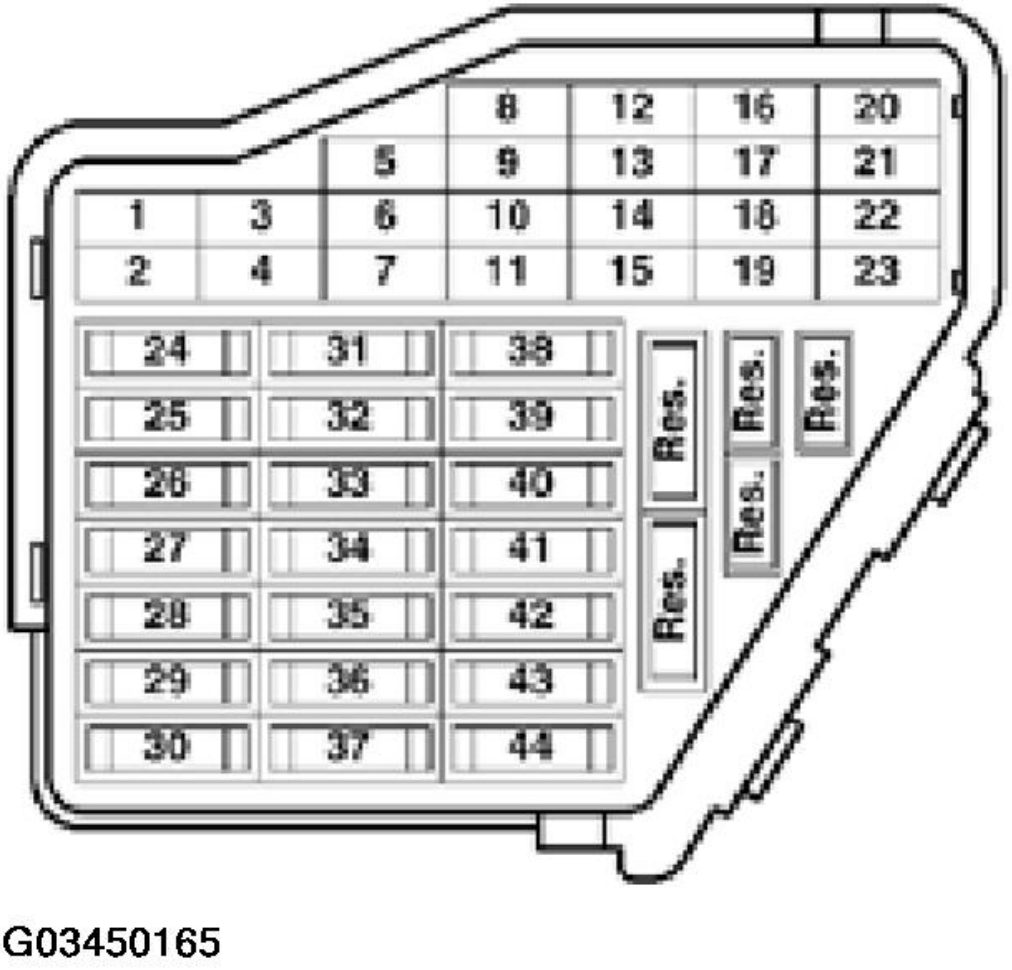


Fig. 190: Identifying Fuses
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Battery voltage must be at least 11.5 V
- All electrical accessories, e.g. lights and rear window defroster must be switched off

- Air conditioner must be switched off
- Selector lever of the automatic transmission must be in "P" or "N" position

Test sequence

- Switch off ignition.
- Unlock Motronic Engine Control Module (ECM) - J220- connector and disconnect it.
- Connect VAG 1598/31 test box to Motronic Engine Control Module (ECM) -J220-. Control module wiring harness is not connected by this action.
- Check centralized adapting resistor in Motronic Engine Control Module (ECM) -J220- by performing a resistance measurement between test box

  Sockets 58 + 60

  Specification: 60 to 72

  If the resistance value is outside the specified range:

- Replace Motronic Engine Control Module (ECM) -J220-, see **MOTRONIC ENGINE CONTROL MODULE (ECM) - J220-, REPLACING** .

  If the resistance value is within the specified range:

- Check CAN-Bus wiring using Electrical Wiring Diagram.